United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with
Michigan Department of
Agriculture, Michigan State
University Extension,
Michigan Agricultural
Experiment Station,
Michigan Technological
University, and Otsego
County

Soil Survey of Otsego County, Michigan

How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

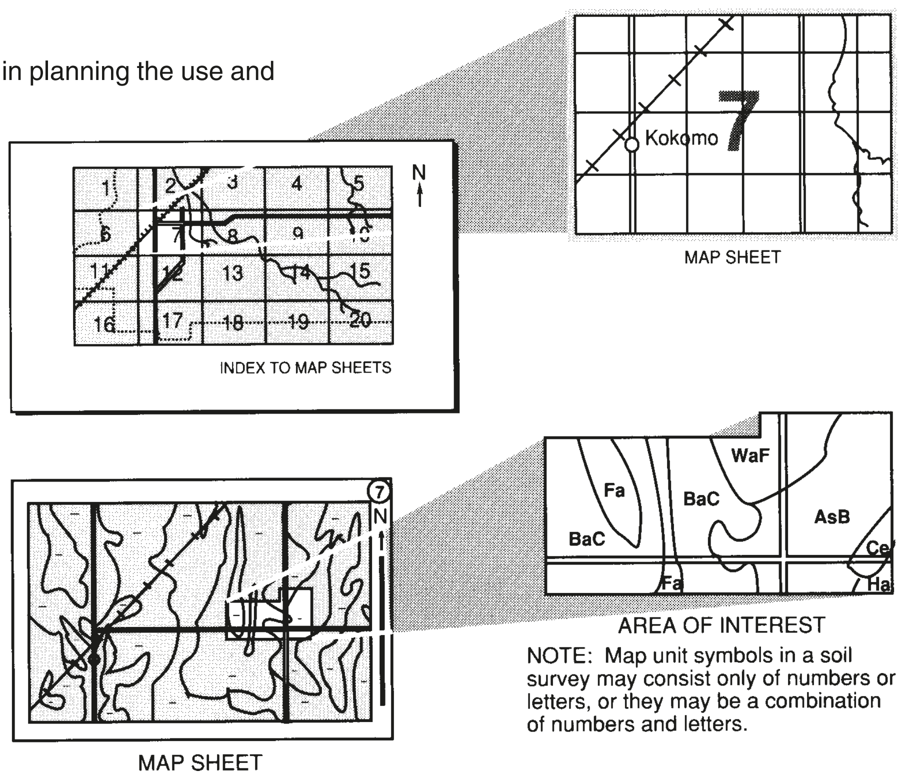
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1997. Soil names and descriptions were approved in 1997. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1997. This survey was made cooperatively by the Natural Resources Conservation Service, the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station, Michigan State University Extension, Michigan Technological University, and Otsego County. Otsego County provided financial assistance. The survey is part of the technical assistance furnished to the Otsego County Soil Conservation District.

Cover: The 18th hole on one of the many golf courses in Otsego County. Blue Lake loamy sand, 6 to 18 percent slopes, is in the foreground. The wetland in the background is an area of Dawson-Loxley peats. Photo courtesy of the Gaylord Area Convention and Tourism Bureau.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is http://www.nrcs.usda.gov.

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Issued 2004

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Ronald C. Williams
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Otsego County, Michigan

By William E. Perkis, Natural Resources Conservation Service

Fieldwork by Kelley A. Bishop-Dukes, Martin L. Kroell III, Christopher J. Pappas, William E. Perkis, and John O. Werlein, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Michigan Department of Agriculture, the Michigan Agricultural Experiment Station, Michigan State University Extension, Michigan Technological University, and Otsego County

OTSEGO COUNTY is in the north-central part of the Lower Peninsula of Michigan (fig. 1). It has an area of 336,749 acres, or about 538 square miles. Gaylord is the county seat as well as the commercial, industrial, and educational center of the county. The population of the county was 17,975 in 1990.

Most of Otsego County consists of gently rolling to steep moraines and remnant moraines, nearly level to very steep outwash plains, and channeled uplands. About 79 percent of the county is forested, 5.5 percent is cropland, 3.3 percent is pasture, 2 percent is open water, and 10.2 percent is urban land, built-up land, land used for transportation, or other land.

The county has 44 different kinds of soil. The soils range widely in texture, natural drainage, slope, and other characteristics. Excessively drained to well drained soils make up about 76 percent of the acreage in the county, moderately well drained soils make up 7 percent, somewhat poorly drained soils make up 2 percent, and poorly drained and very poorly drained soils make up 10 percent. The rest of the county is miscellaneous areas, including water areas.

This soil survey updates the land type map of Otsego County published in 1939 (Michigan Agricultural Experiment Station, 1939). It provides additional information and has larger maps, which show the soils in greater detail. It also recorrelates the portion of the soil survey interim report for Camp Grayling that is within the boundaries of Otsego County (Werlein and Kroell, 1990).

Figure 1.—Location of Otsego County in Michigan.

General Nature of the County

This section gives general information about the county. It describes climate, history and development, industry and transportation facilities, lakes and

streams, farming, physiography and geology, and soils and water quality.

Climate

Prepared by the Water and Climate Center, Natural Resources Conservation Service, Portland, Oregon.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Gaylord in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 19.5 degrees Fahrenheit (F) and the average daily minimum temperature is 11.3 degrees. The lowest temperature on record, which occurred in Gaylord on February 17, 1979, is -37 degrees. In summer, the average temperature is 65.5 degrees and the average daily maximum temperature is 78.2 degrees. The highest recorded temperature, which occurred in Gaylord on August 21, 1955, is 99 degrees.

Growing degree days are shown in table 1. They are equivalent to “heat units.” During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation in Gaylord is about 35.63 inches. Of this, 19 inches, or about 53 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 10.0 inches. The heaviest 1-day rainfall on record was 5.00 inches at Gaylord on August 17, 1995. Thunderstorms occur on about 35 days each year, and most occur in July.

The average seasonal snowfall is about 150 inches. The greatest snow depth at any one time during the period of record was 50 inches. On the average, 129 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 61 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 63 percent of the time possible in summer and 37 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 9.5 miles per hour, in April.

History and Development

Prepared by Bill Granlund, Otsego County Historian.

Otsego County was first laid out in 1840 and given the name “Okkuddo,” which means “sickly” or “stomach pains.” The reason the name was given is not known. In 1843, the name was changed to Otsego, which comes from the Iroquois Indian language. The meaning of the word “Otsego” has been defined in several ways. The two most popular definitions are “a place where meetings are held” and “beautiful lake.”

Though no permanent settlements were established, there was some Native American activity in the survey area during the pre-settlement period. Visitors to the area at that time came for berries, fish, maple sugar, and passenger pigeons.

In 1854, David Ward visited the survey area and claimed large tracts of fine timber. John Mellen, a Federal surveyor, had told Ward of some fine stands of “Cork” pine, a variety of white pine that was highly valued by the lumber interests of Michigan.

In 1868, Alfred A. Dwight, a prominent Detroit lumberman, became the first person to undertake a business in the survey area. The first expedition that he sent to the area, in April of 1868, failed because of poor weather and supply problems. Dwight sent out a second expedition in April of 1869. It established a permanent settlement at Farm Lake, now known as Tecon Lake.

In the fall of 1872, Otsego Lake Village, the first village in the survey area, was established. On March 12, 1878, Otsego County was organized with Otsego Lake as the county seat. Later that year, the county seat was permanently located in the city of Gaylord. Many of the early residents were Civil War veterans who took advantage of the lumber company’s offer of building lots. Other veterans took advantage of the Homestead Act, which provided them with free land.

Early settlements were numerous in Otsego County but by the 1920s were narrowed down to the few that are major population centers today. They include Otsego Lake Village, 1872; Waters (first named Bradford Lake), 1876; Elmira (first named Windsor), 1877; Vanderbilt, 1875; Johannesburg, 1901; and Gaylord (first named Barnes), 1873.

Lumbering was the first major industry in the county. It remained so into the early part of the 20th century (fig. 2). Agriculture also played an important role during the period of early development, when the county produced barley, potatoes, wheat, corn, apples, and maple sugar as well as horses, cattle, sheep, and swine.

Figure 2.—Use of "Big Wheels" to transport logs in the early days of Otsego County. Photo courtesy of the Otsego County Historical Society.

The completion of Interstate 75 and improvements of Michigan Highway 32 (M-32) have made Otsego County a major destination for tourists seeking natural beauty and opportunities for recreational activities. The Pigeon River State Forest with its elk herd has been a great attraction for visitors. One of the last witness trees still standing is in that forest. The tourist industry has become a major source of income for the county. Many eating establishments, motels, resorts, and tourist attractions have moved to the county because of the natural recreational areas that are available. The junction of I-75 and M-32 has made Gaylord a popular stopping off place for fuel and food.

In the 1940s, a large ski resort, the Otsego Ski Club, was established in the county. Today, it is known as Hidden Valley. Hidden Valley, Sylvan Resort (TreeTops), Marsh Ridge, Michaywe, Wilderness Valley, and Beaver Creek Resort provide opportunities for golf or skiing. Otsego Lake State Park and Otsego Lake County Park are important parts of the tourist industry.

There have been close ties between lumbering activity and agricultural activity in the county. The farmers in the early years depended on both activities to make a living. With the loss of a ready market for their agricultural products in the lumbering camps and a place of employment in the winter months, the income of the farmers declined as lumbering activities diminished. Failure to adopt appropriate farming practices resulted in the abandonment of many farms and thus a decline in most kinds of agricultural production since the 1940s.

A large acreage of county land is unsuited to prolonged farming. The county has some excellent farmland that, with proper management, can produce and has produced good crops. Proper land management is being addressed by soil conservation groups. Trees have again become an important "crop" in the county. Trees, potatoes, hay, corn for silage, and beef and dairy cattle will be the major products in the future.

The gas and oil industry is fairly recent in the county. The large deposits of these resources have made the county one of the top producers in the State. The future looks bright for Otsego County, as perhaps it did for the early settlers when they first entered the county.

Industry and Transportation Facilities

Manufacturing has been important in the county since the 1880s. The early emphasis was on wood products. Numerous mills in the county produced lumber, shingles, and lathes. Wood-product plants manufactured a variety of other products. These included toys, tables, baseball bats, shoe lasts, golf heads, bowling pins, barrel parts, sleighs, skidding wheels, wagons, butter bowls, and whippletrees.

In 1910, the Gaylord Motor Car Company was established. It produced cars for about 3 years. One of the cars is on display at the Chamber of Commerce building in Gaylord. Other early manufacturing plants included a bottling plant, a charcoal operation, the Dayton Last Block works, Saginaw Wood products, Huff and Mitchell, and Jackson, Wylie and Company. The first factory was Hindyelman and Walburn, a woodenware factory that made butter bowls and whippletrees. It started in the 1880s. The county currently has numerous manufacturing firms. Because of its central location, it has become a major distribution center for many additional services and products.

The oil and gas industry in Otsego County first began in 1940, when Antrim gas was discovered in Bagley Township (Michigan's Oil and Gas News, 1988). This discovery was long before Antrim gas was exploited on a large-scale commercial basis. The first successful oil well was drilled in 1951, in Chester Township. The early drillings were not very productive, but they did serve to alert the industry of areas that would eventually boom in oil and gas development.

The first "modern era" drilling occurred in 1969, in Hayes Township. It resulted in a productive well from the Northern Niagaran Reef Trend and was soon followed by other drilling. Some of the discoveries during the next 5 years were among the largest and most prolific reef finds ever drilled in Michigan, through 1990.

The large boom in oil and gas exploration occurred in the 1980s. From 1985 to 1990, the density of oil and gas wells in Otsego County increased from just over one well per square mile to nearly five wells per square mile (Michigan's Oil and Gas News, 1988). Most of this activity resulted from the drilling success of shallow Antrim gas wells. Production records reveal that 87 million barrels of oil and 200 billion cubic feet of gas have been produced in Otsego County through the end of 1987. Most of this production has been from the Niagaran Reservoir.

Early transportation was by foot and oxen, and travel was difficult. When the Jackson, Lansing, and Saginaw Railroad reached Otsego Lake in the early 1870s, travel became much easier for prospective settlers. In later years, two other railroads also served the county.

Otsego County has one railroad that is still in operation. It runs south from Gaylord to Grayling. The rail line north of Gaylord was abandoned in 1993.

Roads were improved in the first half of the 20th century. Started in 1913, M-32 is the major east-west travel route from Alpena to Charlevoix. U.S. Highway 27 started in about 1920 and was superseded in 1962 by the opening of Interstate 75, which has become the main travel route from Detroit and other downstate areas to Michigan's Upper Peninsula and has brought prosperity and growth to Otsego County.

River transportation was limited to the moving of logs during the lumbering period. The last log drive took place on the Black River.

The county has one airport, which is located in Gaylord.

Lakes and Streams

There are more than 370 lakes throughout Otsego County. Most of the lakes are in the southern part of the county. The largest lake is Otsego Lake, which has a surface area of 1,972 acres. It is about 3 miles south of Gaylord. Other large lakes in the southern part of the county include Big Lake, Big Bear Lake, Buhl Lake, Crapo Lake, Dixon Lake (fig. 3), Douglas Lake, Guthrie Lake, Heart Lake, Lake Tecon, Manuka Lake, Opal Lake, Turtle Lake, and Pencil Lake. The larger lakes in the northern part of the county are Five Lakes, Hardwood Lake, Lake Twenty Seven, and Pickerel Lake. Many of these are kettle lakes, formed in the depression left by a large block of glacial ice. The ice broke free from the retreating glacier and gradually melted, leaving a water-filled depression.

The headwaters of the Au Sable, Black, Manistee, Pigeon, and Sturgeon Rivers occur in Otsego County. The Au Sable River watershed is the largest watershed in the county. This river drains approximately 38 percent of the county. It is in the south-central and southern parts of the county. The general gradient is to the south.

The Black River watershed is in the northeastern part of the county. This river drains approximately 12 percent of the county. The general gradient is to the north and east.

The Manistee River watershed is along the southwestern edge of the county. This river drains approximately 9 percent of the county. The general gradient is to the south.

Figure 3.—Dixon Lake, which is surrounded by northern hardwoods growing on Mancelona loamy sand, 6 to 12 percent slopes.

The Pigeon River watershed is the north-central part of the county. This river drains about 15 percent of the county. The general gradient is to the north.

The Sturgeon River watershed is in the northwestern part of county. This river drains approximately 24 percent of the county. The general gradient is to the north.

A small part of the Boyne River watershed is along the west-central edge of the county, near Elmira. This river drains less than 2 percent of the county.

Farming

Although farming is not the most important industry in Otsego County, it does have a significant impact on the economy and land use in the county. Approximately 5.5 percent of the total land area in the county currently is active or idle farmland. The county has 133 farms, which average 300 acres in size. The major agricultural products are forage crops, 9,380 acres; corn, 1,460 acres; potatoes, 900 acres; oats, 800 acres; wheat, 700 acres; and cattle and calves, 3,400 head.

On June 15, 1944, local farmers formed the Otsego County Soil Conservation District to assist and educate landowners. The district is active in controlling soil erosion, maintaining or improving productivity, maintaining water quality, and controlling pollution.

Physiography and Geology

Glacial drift is 100 to 600 feet thick throughout most of Otsego County. This glacial veneer is the result of at least four advances of continental glaciers. Only the deposits of the various advances of the last, or Wisconsinan, stage remain exposed at the surface. This last ice sheet melted and receded back from the Otsego County area about 11,800 years ago. The surface features in the county are a result of this glacial action.

There are eight distinct types of surface features in Otsego County. These features are end moraines, remnant moraines, ground moraines, kame terraces, pitted outwash plains, outwash plains, outwash channels, and lake plains (figs. 4 and 5).

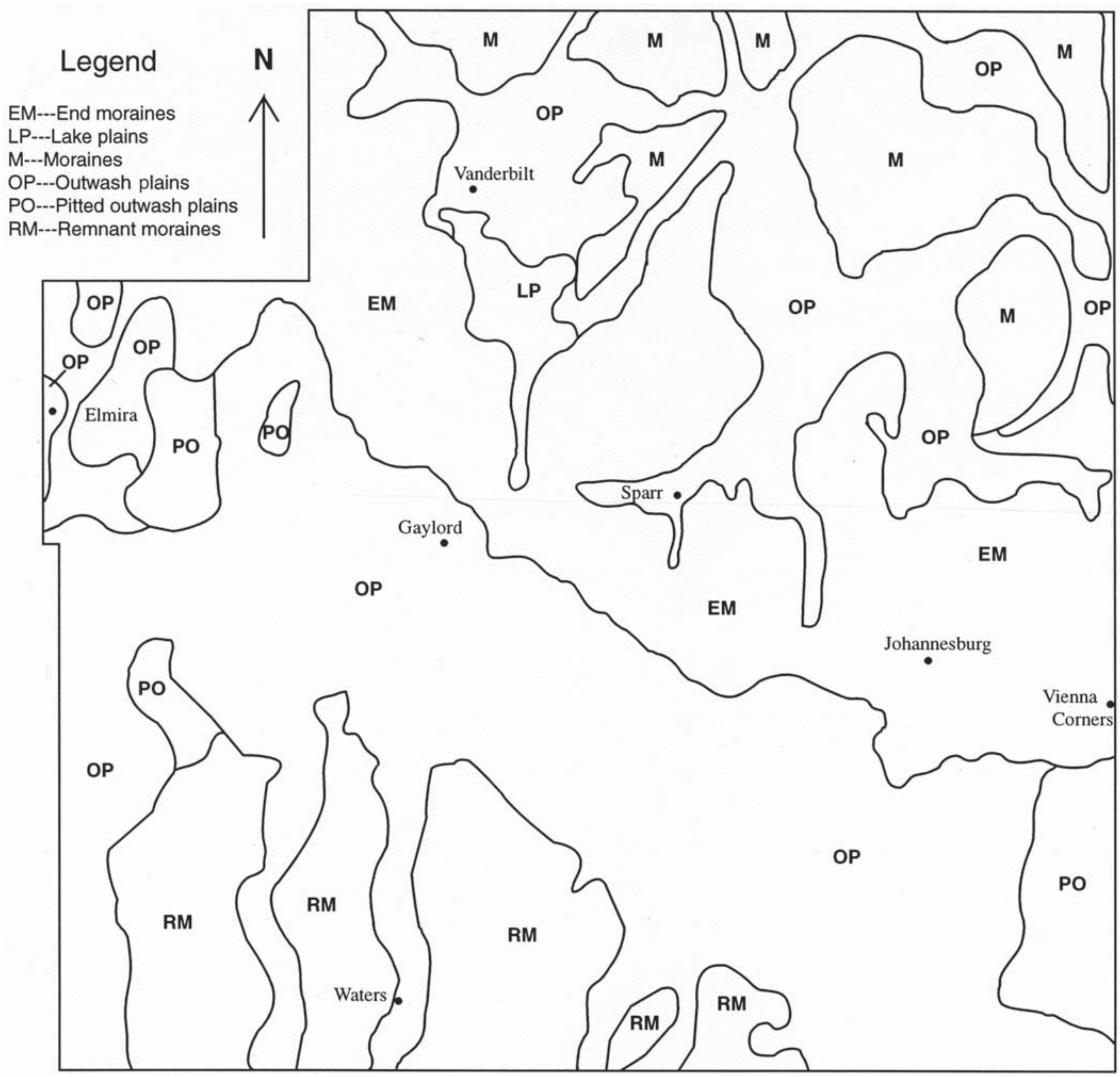

Figure 4.—The dominant glacial landforms in Otsego County. A modification of Burgis and Eschman (1981).

Parallel north-to-south ridges in southwestern Otsego County are parts of a remnant moraine of the Port Bruce ice advance. This moraine was dissected into its conspicuous north-to-south ridges by the meltwater of the Port Huron ice advance. As the Port Huron advance stagnated and retreated, the meltwater dissected the moraine, exposing the sandy glacial drift core of the moraine and forming the outwash channels between the remnants. The fast-moving meltwater deposited the sand and gravel now in the channels. The meltwater outlet for these channels was the valley of the Manistee River and then the basin of Lake Michigan. The iceblocks left behind during the glacial retreat and those rafted by meltwater into the channels were subsequently buried by the ensuing outwash. When these iceblocks eventually melted, they left depressions, many of which are below the regional water table. These depressions filled with water and became lakes. Remnants of ablation till are at the summit of these ridges, at elevations above 1,380 feet.

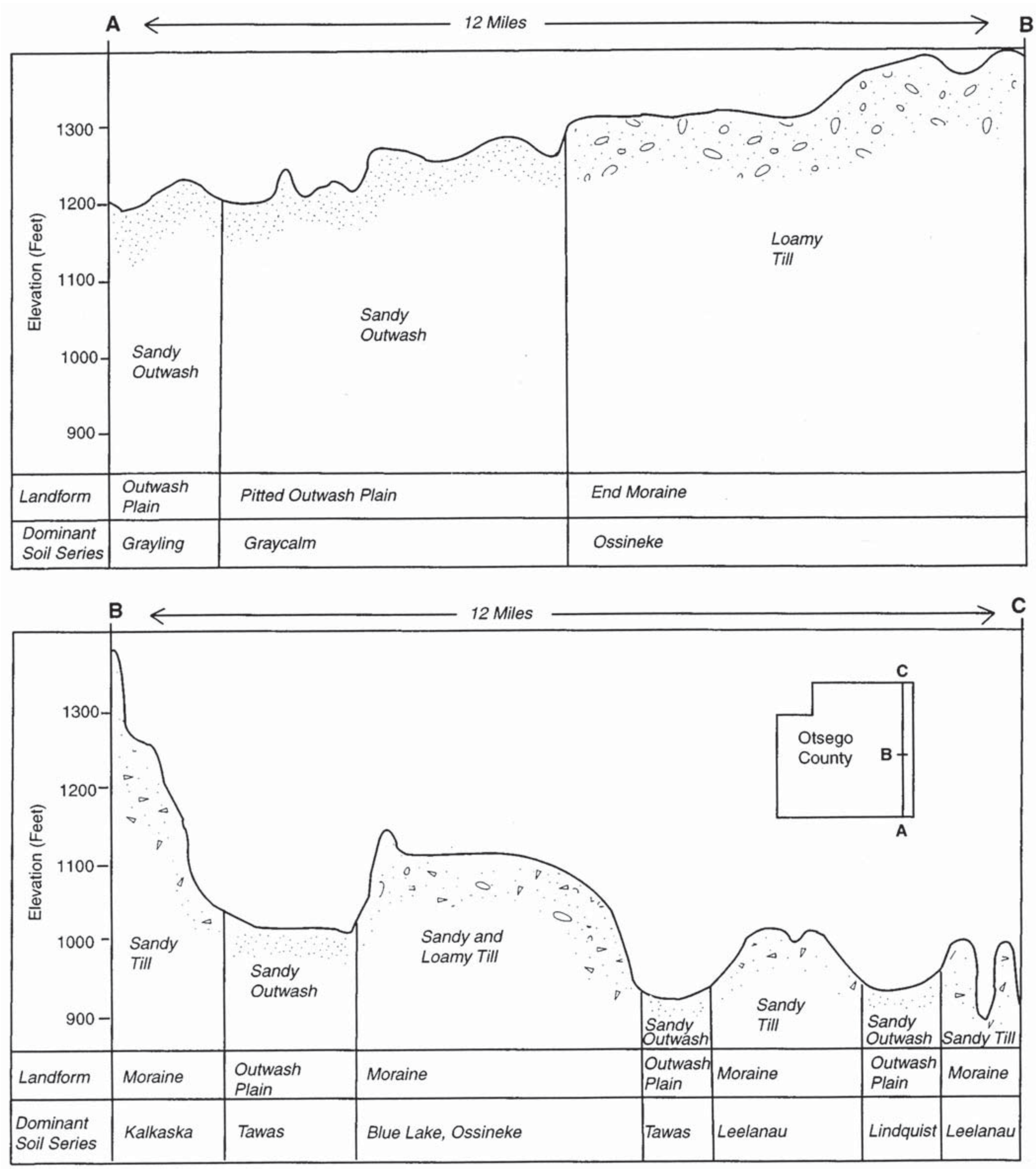

Figure 5.—Topography of Otsego County, from north to south; the relationship between elevation, landforms, parent material, and soil series.

This supraglacial till was deposited as the Port Bruce glacial advance stagnated and the glacier melted in place.

The largest glacial end moraine in the county, the Johannesburg Moraine, extends from the northwest to the southeast through the central part of the county. In most areas of the moraine, loamy glacial till overlies sandy glacial drift or outwash from a previous advance. This moraine marks the terminus of the Port Huron ice advance of about 12,500 years ago. The meltwater released from this advance went both southward, eroding channels into the Port Bruce Moraine, and later southeastward along the ice front through the Lewiston-Au Sable River valley and into Saginaw Bay. The latter flow formed the Gaylord-Lewiston outwash plain, a large level area of sandy glaciofluvial material.

In the northeastern part of the county, dissected ground moraines, called the Atlanta Channeled Uplands, developed about 11,800 years ago, during the Valders readvancement stage. As this stage stagnated and retreated, it left iceblocks and outwash along the northern and southern flanks of the Johannesburg Moraine. Areas of pitted outwash, or small kettlelike depressions, formed in these areas. The meltwater that was formed on the southern aspect of the Johannesburg Moraine was released through the valley of the Au Sable River.

As the ice retreat continued north of its contact with the Johannesburg Moraine, the meltwater was trapped in the channeled uplands. Most of the material in the uplands was deposited during the Port Huron ice retreat. At this time, however, the stagnant ice of the Valders advance melted in place and built up high kamelike masses, which formed the basis of the channeled uplands. The meltwater then flowed through and dissected the glacial drift of the uplands, forming outwash channels and depositing sand and gravel within the channels. Many of the channels are below the regional water table, are filled with organic material, and are swamplike.

In the northwest corner of the county, the Johannesburg Moraine breaks sharply to the southwest. This point of inflection is the renitent angle where the Huron and Michigan Lobes of the Port Huron ice advance met. At this point a kame terrace originated, as the meltwater deposited stratified sand and gravel in a streambed constrained by the Michigan Lobe.

During this time, an area of meltwater southeast of what is now the town of Vanderbilt was contained by an ice dam and a small proglacial lake developed. The lake allowed the fine textured material to settle out of the meltwater and develop a lacustrine deposit in the lake basin. After the ice dam melted, most of the area was subsequently covered with a thin mantle of sandy glacial outwash.

Soils and Water Quality

Otsego County is well known for its high-quality water resources. It is the headwaters for five major river systems and is blessed with an abundance of high-quality lakes and streams. Thousands of tourists and part-time residents enjoy the recreational and esthetic opportunities that these water resources provide.

The attractiveness of the area, however, is resulting in an increase in development pressure. This pressure, in turn, is having a greater impact on the water resources. Ground-water contamination is occurring at an increasing rate. Such sources as leaking underground storage tanks, oil and gas well sites, old dump sites, agricultural areas, and various commercial and residential areas have all contributed to the problem. In order to effectively maintain high-quality water resources, it is imperative that local units of government initiate and implement measures that protect ground water and surface water.

Ground water is at risk in Otsego County. The county is dominated by highly permeable, sandy soils. Most of these soils occur in the southern and southwestern parts of the county. They typically occur south of a line from Big Lake to a point directly north of Elmira. The city of Gaylord is within this area of highly permeable soils. According to well logs, uninterrupted sand and gravel deposits are common to a depth of 100 feet or more. The sand and gravel allow water to quickly pass beyond the root zone and recharge the ground water. Unfortunately, the rapid absorption of the water and the lack of protective clay layers place the ground water at risk of contamination. In many areas of the county, the ground water is within 50 feet of the soil surface. Near wetlands, lakes, and rivers, the ground water can be within a few feet of the surface. In most areas the surface water is an extension of the water table and is directly connected to the ground water. Most of the drinking water wells are just deep enough to reach the uppermost region of the water table. The combination of sandy soils and shallow ground water results in the vulnerability of the ground-water aquifer to contamination.

Soil maps and information about the different soil types in Otsego County are extremely helpful in determining areas that have a high, moderate, or low potential for ground-water contamination. This information can provide a basis for wise land use planning and should help to highlight areas of

vulnerability. With adequate use of planning and zoning tools and the incorporation of information about soils, the ground-water resources of Otsego County can continue to provide safe and healthy drinking water for future generations.

Figure 6 shows the vulnerability to ground-water contamination in Otsego County. It is based on soil interpretations and on the geomorphology and physiography of the land in the county. The least vulnerable areas are generally on the Johannesburg Moraine. They are sandy loam to clay loam to a depth of 80 inches and are characterized by moderately rapid to slow permeability.

The moderately vulnerable areas are generally on the remnant moraines in the southwest corner of the county and in the kamelike masses in the channeled uplands in the northeast corner. The soils in these areas have a texture of loamy sand to loam or are sandy and have bands of loamy sand to sandy loam that have a total thickness of more than 6

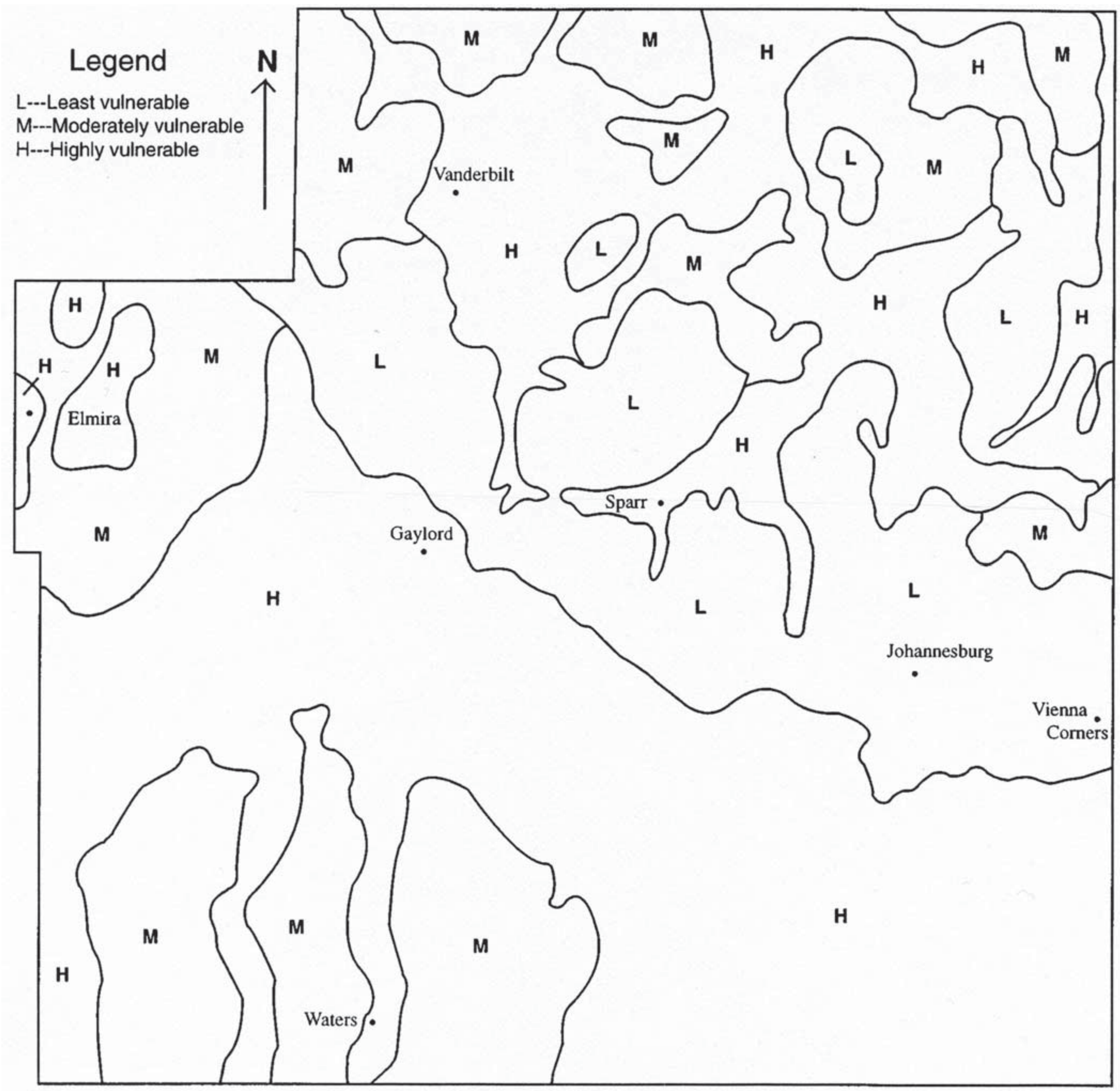

Figure 6.—The vulnerability of Otsego County to ground-water contamination.

inches. Permeability is moderately rapid to moderately slow.

The highly vulnerable areas are generally on outwash plains and in outwash channels in the rest of the county. The soils in these areas have a texture of loamy sand, sand, stratified sand and gravel, or muck. Permeability is rapid in the sandy material. The water table is at or near the surface in the areas of muck.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the county. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the county occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the county. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the county and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the county and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the county, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the survey area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests, as well as the field-observed characteristics and the soil properties, to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the county, they

drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Soil scientists were denied access to some areas in the county. No information about the soils in these areas is available. The areas are identified by the map symbol 380.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each association on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Rubicon-Croswell Association

These nearly level to rolling, excessively drained and moderately well drained soils formed in sandy material mainly on outwash plains. The soils have very low natural fertility and a low water-holding capacity and are highly susceptible to ground-water contamination.

Setting

Landform: Outwash plains, outwash channels, and stream terraces
Slope range: 0 to 18 percent

Composition

Extent of the association:
Less than 1 percent of the county
Extent of the soils in the association:
Rubicon and similar soils—80 percent
Croswell and similar soils—15
Minor soils—5 percent

Soil Properties and Qualities

Rubicon

Drainage class: Excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 18 percent

Croswell

Drainage class: Moderately well drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 6 percent

Minor Soils

- Au Gres soils, which are somewhat poorly drained and are on low flats and in depressions
- Leafriver soils, which are very poorly drained and are in depressions

Use and Management

Major use: Forestland
Management concerns on forestland: Rubicon and Croswell—equipment limitations, seedling mortality; Croswell—windthrow, plant competition

Minor use: Building site development
Management concerns on building sites: Slope in some areas, wetness in the Croswell soils
Management concerns on sites for septic tank absorption fields: Rapid permeability, slope in some areas, wetness in the Croswell soils

2. Grayling Association

These nearly level to rolling, excessively drained soils formed in sandy material mainly on outwash plains. The soils have very low natural fertility and a low water-holding capacity and are highly susceptible to ground-water contamination.

Setting

Landform: Outwash plains, low knolls, and ridges
Slope range: 0 to 18 percent

Composition

Extent of the association:
1 percent of the county
Extent of the soils in the association:
Grayling and similar soils—85 percent
Minor soils—15 percent

Soil Properties and Qualities

Grayling

Drainage class: Excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 18 percent

Minor Soils

- Croswell soils, which are moderately well drained and are on the slightly lower flats, in concave areas, and on the border of depressions
- Au Gres soils, which are somewhat poorly drained and are on low flats and in depressions
- Deford soils, which are very poorly drained and are in depressions

Use and Management

Major uses: Forestland and wildlife habitat
Management concerns on forestland: Equipment limitations, seedling mortality

Minor use: Building site development
Management concern on building sites: Slope in some areas
Management concerns on sites for septic tank absorption fields: Rapid permeability, slope in some areas

3. Graycalm-Grayling Association

These nearly level to rolling, somewhat excessively and excessively drained soils formed in sandy material on outwash plains. The soils have very low natural fertility and a low water-holding capacity and are highly susceptible to ground-water contamination.

Setting

Landform: Outwash plains, some of which are pitted
Slope range: 0 to 18 percent

Composition

Extent of the association:
6 percent of the county
Extent of the soils in the association:
Graycalm—65 percent
Grayling—25 percent
Minor soils—10 percent

Soil Properties and Qualities

Graycalm

Drainage class: Somewhat excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 18 percent

Grayling

Drainage class: Excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 18 percent

Minor Soils

- Lindquist soils, which are somewhat excessively drained, are redder in the subsoil than the major soils, and are in landscape positions similar to those of the major soils
- Croswell soils, which are moderately well drained and are on the slightly lower flats, in concave areas, and on the border of depressions
- Au Gres soils, which are somewhat poorly drained and are on low flats and in depressions
- Deford soils, which are very poorly drained and are in depressions
- Dawson soils, which are very poorly drained and are in closed depressions
- The Udipsamments-Haplorthods-Glossudalfs complex, which is in the Camp Grayling impact area

Use and Management

Major use: Forestland
Management concerns on forestland: Equipment limitations, seedling mortality

Minor use: Building site development
Management concern on building sites: Slope in some areas
Management concerns on sites for septic tank absorption fields: Rapid permeability, slope in some areas

4. Islandlake-Blue Lake-Mancelona Association

These nearly level to very steep, somewhat excessively drained and well drained soils formed in sandy and gravelly material mainly on outwash plains. The soils have moderately low or low natural fertility and a low water-holding capacity and are moderately susceptible or highly susceptible to ground-water contamination.

Setting

Landform: Outwash plains, outwash channels, stream terraces, kame terraces, and kames
Slope range: 0 to 50 percent

Composition

Extent of the association:
11 percent of the county
Extent of the soils in the association:
Islandlake—32 percent
Blue Lake—25 percent
Mancelona—17 percent
Minor soils—26 percent

Soil Properties and Qualities

Islandlake

Drainage class: Somewhat excessively drained
Parent material: Sandy material
Texture of the surface layer: Loamy sand and sand
Slope: 0 to 18 percent

Blue Lake

Drainage class: Well drained
Parent material: Sandy material
Texture of the surface layer: Loamy sand
Slope: 0 to 50 percent

Mancelona

Drainage class: Somewhat excessively drained
Parent material: Sandy and gravelly material
Texture of the surface layer: Loamy sand
Slope: 0 to 50 percent

Minor Soils

- Kalkaska soils, which are somewhat excessively drained, do not have gravel in the substratum or lamellae in the subsoil, and are in landscape positions similar to those of the major soils
- Lindquist soils, which are somewhat excessively drained, have less development in the subsoil than the major soils, and are in landscape positions similar to those of the major soils
- East Lake soils, which are somewhat excessively drained, do not have lamellae in the substratum, and are in landscape positions similar to those of the major soils

Use and Management

Major use: Forestland
Management concerns on forestland: Equipment limitations, water erosion in some areas, seedling mortality
Minor uses: Cropland, pasture, and building site development
Management concerns on cropland: Droughtiness and soil blowing
Management concern on pasture: Droughtiness
Management concern on building sites: Slope in some areas
Management concerns on sites for septic tank absorption fields: Rapid permeability, slope in some areas

5. Kalkaska-Blue Lake-Rubicon Association

These nearly level to very steep, well drained to excessively drained soils formed in sandy material mainly on moraines and outwash plains (fig. 7). The soils have moderately low or low natural fertility and a low water-holding capacity and are moderately susceptible or highly susceptible to ground-water contamination.

Setting

Landform: Dissected remnant moraines, channeled uplands, stream terraces, and outwash channels
Slope range: 0 to 50 percent

Composition

Extent of the association:
18 percent of the county
Extent of the soils in the association:
Kalkaska—50 percent
Blue Lake—25 percent
Rubicon—10 percent
Minor soils—15 percent

Soil Properties and Qualities

Kalkaska

Drainage class: Somewhat excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 8 to 50 percent

Blue Lake

Drainage class: Well drained
Parent material: Sandy material
Texture of the surface layer: Loamy sand
Slope: 0 to 50 percent

Rubicon

Drainage class: Excessively drained
Parent material: Sandy material

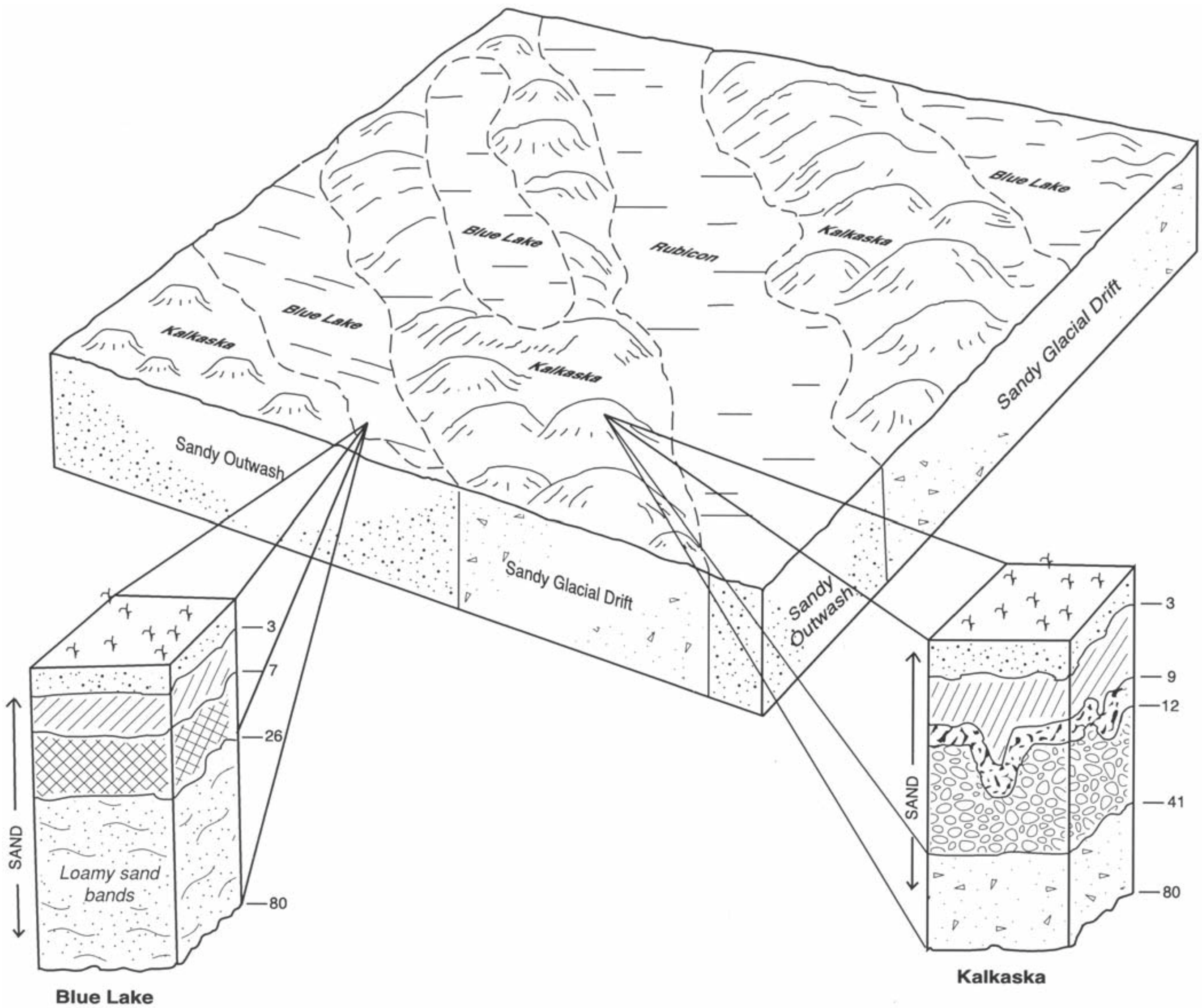

Figure 7.—Typical pattern of soils and parent material in the Kalkaska-Blue Lake-Rubicon association. Depth is indicated in inches.

Texture of the surface layer: Sand
Slope: 0 to 18 percent

Minor Soils

- Leelanau soils, which are well drained, have more development in the subsoil than the major soils, and are on moraines
- Lindquist soils, which are somewhat excessively drained, have less development in the subsoil than the major soils, and are in outwash channels
- Islandlake soils, which are somewhat excessively drained and are on outwash plains
- Croswell soils, which are moderately well drained and are on the slightly lower flats, in concave areas, and on the border of depressions
- Au Gres soils, which are somewhat poorly drained and are on low flats and in depressions

Use and Management

Major use: Forestland
Management concerns on forestland: Equipment limitations, water erosion on side slopes, seedling mortality

Minor uses: Pasture and building site development
Management concern on pasture: Droughtiness
Management concern on building sites: Slope in some areas
Management concerns on sites for septic tank absorption fields: Rapid permeability, slope in some areas

6. Rubicon-Lindquist Association

These nearly level to steep, excessively drained and somewhat excessively drained soils formed in sandy material mainly on moraines and outwash plains. The soils have low natural fertility and a low water-holding capacity and are highly susceptible to ground-water contamination.

Setting

Landform: Moraines, outwash channels, and outwash plains
Slope range: 0 to 35 percent

Composition

Extent of the association:
26 percent of the county
Extent of the soils in the association:
Rubicon—67 percent
Lindquist—28 percent
Minor soils—5 percent

Soil Properties and Qualities

Rubicon

Drainage class: Excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 35 percent

Lindquist

Drainage class: Somewhat excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 35 percent

Minor Soils

- Grayling soils, which are excessively drained, have less development in the subsoil than the major soils, and are on outwash plains
- East Lake soils, which are excessively drained, have more gravel in the subsoil than the major soils, and are on outwash plains
- Dawson and Loxley soils, which are organic and are in closed depressions
- Croswell soils, which are moderately well drained and are adjacent to depressions on outwash plains
- Au Gres soils, which are somewhat poorly drained and are on terraces adjacent to drainageways and in shallow depressions
- Deford soils, which are very poorly drained and are in depressions
- Tawas soils, which are organic and are in depressions and drainageways

Use and Management

Major use: Forestland
Management concerns on forestland: Equipment limitations, water erosion in the steeper areas, seedling mortality

Minor use: Building site development
Management concern on building sites: Slope
Mangement concerns on sites for septic tank absorption fields: Rapid permeability, slope

7. Leelanau-Lindquist Association

These nearly level to very steep, well drained and somewhat excessively drained soils formed in sandy material mainly on moraines and outwash plains (fig. 8). The soils have moderately low or low natural fertility and a low water-holding capacity and are moderately susceptible or highly susceptible to ground-water contamination.

Setting

Landform: Channeled uplands, till plains, and outwash channels
Slope range: 0 to 50 percent

Composition

Extent of the association:
4 percent of the county
Extent of the soils in the association:
Leelanau—82 percent
Lindquist—8 percent
Minor soils—10 percent

Soil Properties and Qualities

Leelanau

Drainage class: Well drained
Parent material: Loamy sand
Texture of the surface layer: Loamy sand
Slope: 0 to 50 percent

Lindquist

Drainage class: Somewhat excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 0 to 18 percent

Minor Soils

- Blue Lake soils, which are well drained and are in landscape positions similar to those of the major soils
- East Lake soils, which are somewhat excessively

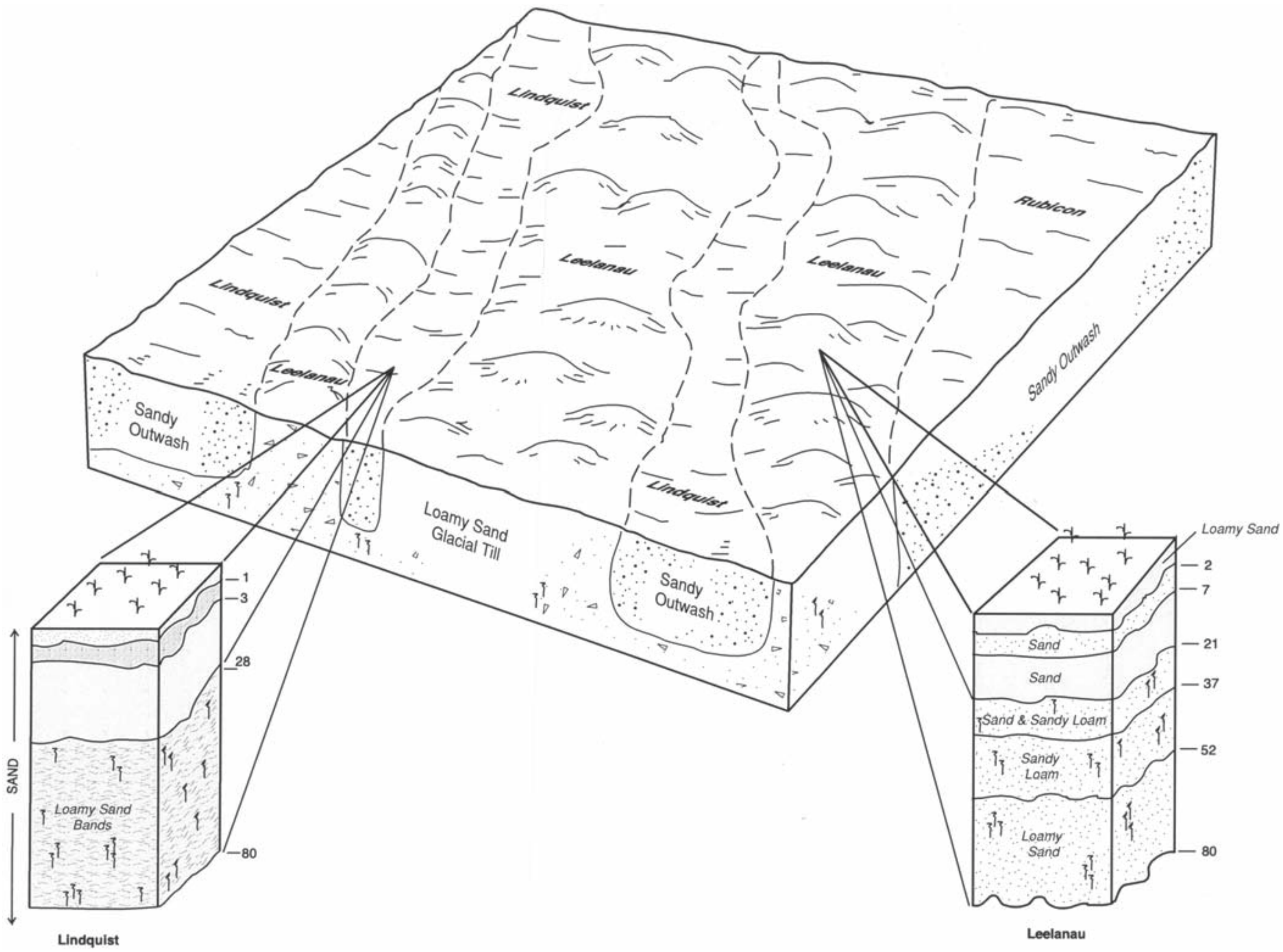

Figure 8.—Typical pattern of soils and parent material in the Leelanau-Lindquist association. Depth is indicated in inches.

drained, have more gravel in the substratum than the major soils, and are on kames
- Chinwhisker soils, which are moderately well drained and are on the slightly lower flats, in concave areas, and on the border of depressions
- Ausable soils, which are very poorly drained and are on flood plains
- Rubicon soils, which are excessively drained and are in landscape positions similar to those of the major soils

Use and Management

Major use: Forestland
Management concerns on forestland: Seedling mortality, water erosion

Minor use: Building site development
Management concern on building sites: Slope in some areas
Management concerns on sites for septic tank absorption fields: Rapid permeability, slope in some areas

8. Blue Lake-Feldhauser-Kalkaska Association

These nearly level to very steep, moderately well drained to somewhat excessively drained soils formed in sandy and loamy material mainly on remnant moraines. The soils have moderate or moderately low natural fertility and a moderate or low water-holding capacity and are moderately susceptible to ground-water contamination.

Setting

Landform: Dissected remnant moraines and summits
Slope range: 0 to 50 percent

Composition

Extent of the association:
2 percent of the county
Extent of the soils in the association:
Blue Lake—55 percent
Feldhauser and similar soils—25 percent
Kalkaska—18 percent
Minor soils—2 percent

Soil Properties and Qualities

Blue Lake

Drainage class: Well drained
Parent material: Sandy material
Texture of the surface layer: Loamy sand
Slope: 0 to 50 percent

Feldhauser

Drainage class: Moderately well drained
Parent material: Loamy material underlain by sandy material
Texture of the surface layer: Fine sandy loam
Slope: 0 to 6 percent

Kalkaska

Drainage class: Somewhat excessively drained
Parent material: Sandy material
Texture of the surface layer: Sand
Slope: 8 to 50 percent

Minor Soils

- Hartwick soils, which are somewhat excessively drained, have gravel in the substratum, and are in outwash channels
- Lindquist soils, which are somewhat excessively drained, have less development in the subsoil than the major soils, and are in landscape positions similar to those of the major soils

Use and Management

Major use: Forestland
Management concerns on forestland: Equipment limitations, water erosion on side slopes, seedling mortality in some areas

Minor uses: Cropland, pasture, and building site development
Management concerns on cropland: Water erosion, tilth, compaction
Management concerns on pasture: Compaction, seasonal wetness on summits, droughtiness on side slopes
Management concerns on building sites: Wetness on summits, slope on side slopes
Management concerns on sites for septic tank absorption fields: Wetness on summits, rapid permeability, slope on side slopes

9. Blue Lake-Mossback-Mancelona Association

These nearly level to very steep, well drained and somewhat excessively drained soils formed in sandy and loamy material mainly on moraines. The soils have moderate or moderately low natural fertility and a moderate or low water-holding capacity and are moderately susceptible to ground-water contamination.

Setting

Landform: Terminal moraines, till plains, dissected moraines in the channeled uplands, kames, and stream terraces
Slope range: 0 to 70 percent

Composition

Extent of the association:
14 percent of the county
Extent of the soils in the association:
Blue Lake—35 percent
Mossback—30 percent
Mancelona—20 percent
Minor soils—15 percent

Soil Properties and Qualities

Blue Lake

Drainage class: Well drained
Parent material: Sandy material
Texture of the surface layer: Loamy sand
Slope: 0 to 50 percent

Mossback

Drainage class: Well drained
Parent material: Sandy loam underlain by sandy material
Texture of the surface layer: Sandy loam
Slope: 0 to 35 percent

Mancelona

Drainage class: Somewhat excessively drained
Parent material: Sandy and gravelly material

Texture of the surface layer: Loamy sand
Slope: 0 to 70 percent

Minor Soils

- Lindquist soils, which are somewhat excessively drained, have less development in the subsoil than the major soils, and are in landscape positions similar to those of the major soils
- Morganlake soils, which are moderately well drained, have sandy material that is 20 to 40 inches deep over loamy material, and are in nearly level areas
- Menominee soils, which are well drained, have sandy material that is 20 to 40 inches deep over loamy material, and are in landscape positions similar to those of the major soils
- Bamfield soils, which are well drained, have more clay in the subsoil than the major soils, and are in landscape positions similar to those of the major soils
- Leafriver soils, which are very poorly drained, are organic in the upper part and sandy in the lower part, and are in depressions
- Gladwin soils, which are somewhat poorly drained and are in depressions

Use and Management

Major uses: Forestland and cropland
Management concerns on forestland: Equipment limitations, water erosion in the steeper areas
Management concerns on cropland: Droughtiness, water erosion

Minor uses: Pasture and building site development
Management concern on pasture: Overgrazing
Management concern on building sites: Slope in some areas
Management concern on sites for septic tank absorption fields: Slope in some areas

10. Ossineke-Blue Lake-Morganlake Association

These nearly level to very steep, moderately well drained and well drained soils formed in sandy and loamy material mainly on moraines. The soils have low to high natural fertility and a moderate or low water-holding capacity and are moderately susceptible or slightly susceptible to ground-water contamination.

Setting

Landform: Terminal moraines and till plains
Slope range: 0 to 50 percent

Composition

Extent of the association:
9 percent of the county
Extent of the soils in the association:
Ossineke—30 percent
Blue Lake—29 percent
Morganlake—25 percent
Minor soils—16 percent

Soil Properties and Qualities

Ossineke

Drainage class: Moderately well drained
Parent material: Loamy material underlain by sandy material
Texture of the surface layer: Fine sandy loam
Slope: 0 to 12 percent

Blue Lake

Drainage class: Well drained
Parent material: Sandy material
Texture of the surface layer: Loamy sand
Slope: 0 to 50 percent

Morganlake

Drainage class: Moderately well drained
Parent material: Loamy sand underlain by loamy material
Texture of the surface layer: Loamy sand
Slope: 0 to 12 percent

Minor Soils

- Mancelona soils, which are somewhat excessively drained, have more gravel in the substratum than the major soils, and are on kames and in outwash channels
- Bamfield and Menominee soils, which are well drained and are in the steeper areas
- Kent soils, which are moderately well drained, have more clay than the major soils, and are in landscape positions similar to those of the major soils
- Slade soils, which are somewhat poorly drained and are in shallow depressions
- Angelica soils, which are poorly drained and are in depressions
- Cathro soils, which are organic and are in depressions

Use and Management

Major uses: Forestland and cropland
Management concerns on forestland: Equipment limitations

Management concern on cropland: Water erosion

Minor uses: Pasture and building site development
Management concern on pasture: Overgrazing
Management concerns on building sites: Shrink-swell potential, frost action, wetness, slope in some areas
Management concerns on sites for septic tank absorption fields: Moderately slow or slow permeability, wetness, slope in some areas

11. Tawas-Lupton Association

These nearly level, very poorly drained soils formed in muck or in muck over sandy material. They are mainly in depressions and drainageways. The soils have low natural fertility, have a high water-holding capacity in the organic layers and a low water-holding capacity in the sandy material, and are highly susceptible to ground-water contamination.

Setting

Landform: Drainageways, flood plains, and depressions on outwash plains, in outwash channels, and on moraines
Slope range: 0 to 2 percent

Composition

Extent of the association:
8 percent of the county
Extent of the soils in the association:
Tawas—53 percent
Lupton—32 percent
Minor soils—15 percent

Soil Properties and Qualities

Tawas

Drainage class: Very poorly drained
Parent material: Organic material that is 16 to 51 inches deep over sandy material
Texture of the surface layer: Muck
Slope: 0 to 2 percent

Lupton

Drainage class: Very poorly drained
Parent material: More than 51 inches of organic material
Texture of the surface layer: Muck
Slope: 0 to 2 percent

Minor Soils

- Croswell soils, which are moderately well drained, are sandy throughout, and are on islands, terraces, and outwash plains
- Au Gres soils, which are somewhat poorly drained, are sandy throughout, and are on islands and terraces
- Ausable and Bowstring soils, which have alternating layers of mineral and organic material and are on flood plains
- Histosols and Aquents, which are ponded and are in depressions and near areas of open water
- Kellogg soils, which are moderately well drained, have sandy material that is 20 to 40 inches deep over clayey material, and are on lake plains

Use and Management

Major uses: Forestland, recreational development, and wildlife habitat
Management concerns on forestland: Equipment limitations, windthrow, seedling mortality

Detailed Soil Map Units

The map units delineated on the detailed maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Islandlake loamy sand, 0 to 6 percent slopes, is a phase of the Islandlake series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Deford-Au Gres-Croswell complex, 0 to 6 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. An example of an undifferentiated group in this survey area is the map unit Histosols and Aquents, ponded.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, borrow, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

13—Tawas-Lupton mucks

Setting

Landform: Low flats, depressions, and drainageways on outwash plains and end moraines
Slope: 0 to 2 percent
Shape of areas: Irregular or oval
Size of areas: 3 to 4,180 acres

Typical Profile

Tawas

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 24 inches—black and very dark gray muck

Substratum:
24 to 80 inches—dark gray sand

Lupton

Surface layer:
0 to 13 inches—black muck

Substratum:
13 to 80 inches—black muck

Soil Properties and Qualities

Permeability: Tawas—moderately slow to moderately rapid in the organic material and rapid in the underlying sand; Lupton—moderately slow to moderately rapid
Available water capacity: High
Drainage class: Very poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface throughout the year
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Composition

Tawas and similar soils: 35 to 70 percent
Lupton and similar soils: 25 to 50 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils in the slightly higher landscape positions
- The very poorly drained Deford soils in landscape positions similar to those of the Tawas and Lupton soils
- Small areas of open water

Similar inclusions:
- Areas near the Tawas soil where thin layers of loamy material are in the substratum
- Areas near the Tawas soil where the muck is more than 9 inches and less than 16 inches thick
- Soils that are very strongly acid in some parts

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, severe seedling mortality, and plant competition, trees are generally not planted on these soils.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concern: Ponding
Management considerations:
- Because of ponding, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding
Management considerations:
- Because of ponding, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w
Forestland ordination symbol: Tawas—5W; Lupton—2W
Michigan soil management group: Tawas—M/4c; Lupton—Mc

14—Dawson-Loxley peats

Setting

Landform: Low flats and closed depressions on outwash plains and end moraines
Slope: 0 to 2 percent
Shape of areas: Irregular or oval
Size of areas: 3 to 80 acres

Typical Profile

Dawson

Surface layer:
0 to 3 inches—dark reddish brown peat

Subsoil:
3 to 32 inches—dark reddish brown muck

Substratum:
32 to 80 inches—dark grayish brown sand

Loxley

Surface layer:
0 to 3 inches—dark reddish brown peat

Substratum:
3 to 80 inches—dark reddish brown muck

Soil Properties and Qualities

Permeability: Dawson—moderately slow to moderately rapid in the organic material and rapid in the underlying sand; Loxley—moderately slow to moderately rapid
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface throughout the year
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: Low
Potential for frost action: High

Composition

Dawson and similar soils: 35 to 70 percent
Loxley and similar soils: 25 to 60 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils in the slightly higher landscape positions
- The very poorly drained Deford soils in landscape positions similar to those of the Dawson and Loxley soils
- Small areas of open water

Similar inclusions:
- Areas near the Dawson soil where thin layers of loamy material are in the substratum
- Areas near the Dawson soil where the organic material is less than 16 inches thick
- Soils that are less acid in some parts

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- These soils are generally unsuited to forestland because of extreme acidity, the low strength of the organic material, and the wetness. Overcoming these limitations is not practical.
- The tree cover is sparse. Some spruce and tamarack grow around the edges of the unit. Shrubs are the most common plants.

Buildings

Major management concern: Ponding
Management considerations:
- Because of ponding, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding

Management considerations:
- Because of ponding, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7w
Forestland ordination symbol: 2W
Michigan soil management group: Dawson—M/4c-a; Loxley—Mc-a

15A—Croswell-Au Gres sands, 0 to 3 percent slopes

Setting

Landform: Flats, shallow depressions, and areas adjacent to drainageways on outwash plains and stream terraces; also, low knolls in swamps
Shape of areas: Irregular
Size of areas: 3 to 60 acres

Typical Profile

Croswell

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 27 inches—brown and strong brown sand
27 to 40 inches—brownish yellow, mottled sand

Substratum:
40 to 80 inches—very pale brown sand

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 42 inches—brown, dark yellowish brown, and yellowish brown, mottled sand

Substratum:
42 to 80 inches—brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Croswell—moderately well drained; Au Gres—somewhat poorly drained
Seasonal high water table: Croswell—apparent, 2.0 to 3.5 feet below the surface at some time from October through December and from March through June; Au Gres—apparent, 0.5 foot to 1.5 feet below the surface at some time from October through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Croswell—low; Au Gres—moderate

Composition

Croswell and similar soils: 60 to 70 percent
Au Gres and similar soils: 20 to 40 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The very poorly drained Leafriver soils in depressions
- The excessively drained Grayling and Rubicon soils on low knolls or the higher flats

Similar inclusions:
- Areas near the Croswell soil where the seasonal high water table is at a depth of 3.5 to 5.0 feet
- Areas where the soil is poorly drained
- Areas where the subsoil is lighter in color
- Areas where the subsoil is partially cemented

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Equipment should be used only when the Au Gres soil is relatively dry or has an adequate snow cover.
- In areas of the Au Gres soil, trees that can withstand seasonal wetness should be selected for planting.
- In areas of the Au Gres soil, windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because loose sand in areas of the Croswell soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the Croswell soil is moist can reduce the seedling mortality rate.

- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Pasture

Major management concerns: Seasonal droughtiness, seasonal wetness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- A planned grazing system and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, seasonal wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness, rapid permeability
Management considerations:
- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots in areas of the Croswell soil, an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in the Croswell soil.
- Because of the high water table, the Au Gres soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Croswell—4s; Au Gres—4w
Forestland ordination symbol: Croswell—5S; Au Gres—6W
Michigan soil management group: Croswell—5a; Au Gres—5b

16B—Graycalm sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 50 to 1,000 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 19 inches—brownish yellow and yellowish brown sand
19 to 80 inches—yellowish brown sand with bands of strong brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Graycalm and similar soils: 85 to 90 percent
Contrasting inclusions: 10 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell and somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Sandy soils that do not have bands of loamy sand in the substratum
- Sandy soils that have a darker subsoil
- Coarse-loamy soils that have a gravelly substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 6S
Michigan soil management group: 5a

17A—Croswell sand, 0 to 3 percent slopes

Setting

Landform: Flats adjacent to drainageways and swamps on outwash plains and stream terraces
Shape of areas: Irregular or linear
Size of areas: 3 to more than 400 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 27 inches—brown and strong brown sand
27 to 40 inches—brownish yellow, mottled sand

Substratum:
40 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: Apparent, 2.0 to 3.5 feet below the surface at some time from October through December and from March through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Croswell and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Grayling and Rubicon soils in landscape positions similar to or slightly higher than those of the Croswell soil

Similar inclusions:
- Soils that are somewhat poorly drained
- Areas where the subsoil is lighter in color
- Areas where the seasonal high water table is at a depth of 3.5 to 5.0 feet

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition

Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, seasonal wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness, rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 5S
Michigan soil management group: 5a

17B—Croswell sand, 0 to 6 percent slopes

Setting

Landform: Undulating outwash plains and stream terraces
Shape of areas: Irregular or linear
Size of areas: 3 to more than 400 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 27 inches—brown and strong brown sand
27 to 40 inches—brownish yellow, mottled sand

Substratum:
40 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: Apparent, 2.0 to 3.5 feet below the surface at some time from October through December and from March through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Croswell and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Grayling and Rubicon soils in landscape positions similar to or slightly higher than those of the Croswell soil

Similar inclusions:
- Soils that are somewhat poorly drained
- Areas where the subsoil is lighter in color
- Areas where the seasonal high water table is at a depth of 3.5 to 5.0 feet

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, seasonal wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Seasonal wetness, rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 5S
Michigan soil management group: 5a

18A—Au Gres sand, 0 to 3 percent slopes

Setting

Landform: Shallow depressions on outwash plains and stream terraces; also, low knolls in swamps
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 42 inches—brown, dark yellowish brown, and yellowish brown, mottled sand

Substratum:
42 to 80 inches—brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: Apparent, 0.5 foot to 1.5 feet below the surface at some time from October through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Au Gres and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Grayling and Rubicon soils on low knolls and ridges
- The very poorly drained Leafriver soils in depressions

Similar inclusions:
- Sandy soils that are moderately well drained

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, windthrow hazard, plant competition
Management considerations:
- Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Pasture

Major management concern: Seasonal wetness
Management considerations:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

Buildings

Major management concerns: Caving of cutbanks, seasonal wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Wetness can be reduced by a drainage system around structures with basements and crawl spaces.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concern: Seasonal wetness
Management considerations:
- Because of the high water table, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 4w
Forestland ordination symbol: 6W
Michigan soil management group: 5b

19—Leafriver muck

Setting

Landform: Shallow depressions and flood plains on outwash plains
Slope: 0 to 1 percent
Shape of areas: Elongated or irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 11 inches—very dark gray mucky sand

Substratum:
11 to 15 inches—dark grayish brown, mottled sand
15 to 80 inches—grayish brown, mottled sand

Soil Properties and Qualities

Permeability: Moderate or moderately rapid in the organic material and rapid in the sandy material
Available water capacity: Moderate
Drainage class: Very poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface throughout the year
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Composition

Leafriver and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils in the higher areas and on low knolls

Similar inclusions:
- Soils that have a thicker organic surface layer
- Sandy soils that are poorly drained

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations,

windthrow hazard, seedling mortality, plant competition

Management considerations:
- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concern: Ponding
- Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w
Forestland ordination symbol: 2W
Michigan soil management group: 5c

20B—Graycalm-Grayling sands, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains
Shape of areas: Irregular
Size of areas: 3 to more than 3,200 acres

Typical Profile

Graycalm

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 19 inches—brownish yellow and yellowish brown sand
19 to 80 inches—yellowish brown sand with thin bands of strong brown loamy sand

Grayling

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 27 inches—dark yellowish brown and yellowish brown sand

Substratum:
27 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Grayling—excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Graycalm and similar soils: 45 to 60 percent
Grayling and similar soils: 30 to 50 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in swales

Similar inclusions:
- Soils that have bands of fine sand or gravelly sand in the subsoil or substratum

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist and planting

special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: Graycalm—4s; Grayling—6s
Forestland ordination symbol: Graycalm—6S; Grayling—4S
Michigan soil management group: Graycalm—5a; Grayling—5.7a

20D—Graycalm-Grayling sands, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on outwash plains
Shape of areas: Irregular or linear
Size of areas: 3 to 310 acres

Typical Profile

Graycalm

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 19 inches—brownish yellow and yellowish brown sand
19 to 80 inches—yellowish brown sand with thin bands of strong brown loamy sand

Grayling

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 27 inches—dark yellowish brown and yellowish brown sand

Substratum:
27 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Grayling—excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight or moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Graycalm and similar soils: 40 to 60 percent
Grayling and similar soils: 35 to 55 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soil in depressions

Similar inclusions:
- Soils that have bands of fine sand or gravelly sand in the subsoil or substratum

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concerns: Caving of cutbanks, slope

Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Graycalm—6s; Grayling—7s
Forestland ordination symbol: Graycalm—6S; Grayling—4S
Michigan soil management group: Graycalm—5a; Grayling—5.7a

20F—Graycalm-Grayling sands, 18 to 45 percent slopes

Setting

Landform: Hills, ridges in areas of pitted outwash, and escarpments along drainageways
Shape of areas: Irregular or linear
Size of areas: 3 to 250 acres

Typical Profile

Graycalm

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 19 inches—brownish yellow and yellowish brown sand
19 to 80 inches—yellowish brown sand with thin bands of strong brown loamy sand

Grayling

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 27 inches—dark yellowish brown and yellowish brown sand

Substratum:
27 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Graycalm—somewhat excessively drained; Grayling—excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Graycalm and similar soils: 40 to 60 percent
Grayling and similar soils: 30 to 60 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil or substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- The risk of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.

- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- Southern exposures may have higher seedling mortality rates than northern exposures.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because of the slope, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- Because of the slope, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: Graycalm—6R; Grayling—4R
Michigan soil management group: Graycalm—5a; Grayling—5.7a

23—Ausable-Bowstring mucks, frequently flooded

Setting

Landform: Flood plains along perennial rivers and creeks (fig. 9)
Slope: 0 to 2 percent
Shape of areas: Irregular or linear
Size of areas: 3 to 150 acres

Figure 9.—An area of Ausable-Bowstring mucks, frequently flooded.

Typical Profile

Ausable

Surface layer:
0 to 10 inches—black and very dark grayish brown muck

Substratum:
10 to 18 inches—grayish brown sand with thin layers of black muck
18 to 46 inches—light olive brown, mottled sand
46 to 52 inches—black muck
52 to 80 inches—light olive brown, mottled, stratified sand and gravel

Bowstring

Surface layer:
0 to 9 inches—black muck

Substratum:
9 to 44 inches—very dark brown and dark brown muck
44 to 50 inches—dark grayish brown sand with thin bands of black muck
50 to 54 inches—dark brown muck
54 to 65 inches—dark grayish brown sand with thin bands of black muck
65 to 80 inches—grayish brown, mottled sand

Soil Properties and Qualities

Permeability: Ausable—moderate or moderately rapid in the organic material and rapid in the underlying sand; Bowstring—moderately slow to moderately rapid
Available water capacity: Ausable—high; Bowstring—very high
Drainage class: Very poorly drained
Seasonal high water table: Ausable—apparent, 1.0 foot above to 1.0 foot below the surface throughout the year; Bowstring—apparent, at the surface to 2.0 feet below the surface throughout the year
Surface runoff class: Negligible
Flooding: Frequent, from October through June
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Ausable—moderate; Bowstring—high

Composition

Ausable and similar soils: 40 to 90 percent
Bowstring and similar soils: 10 to 50 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions
- The somewhat poorly drained Au Gres and moderately well drained Croswell soils in the higher landscape positions

Similar inclusions
- Soils with 16 to 50 inches of muck overlying the sand
- Areas near the Ausable soil where the substratum averages more than 35 percent gravel

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on these soils.

Buildings

Major management concerns: Seasonal flooding, wetness
Management considerations:
- These soils are generally unsuited to building site development because of seasonal flooding, wetness, and low strength.

Septic tank absorption fields

Major management concerns: Seasonal flooding, wetness
Management considerations:
- Because of flooding, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Ausable—7w; Bowstring—6w
Forestland ordination symbol: Ausable—2W; Bowstring—3W
Michigan soil management group: Ausable—L-4c; Bowstring—L-Mc

24A—Kinross-Au Gres complex, 0 to 3 percent slopes

Setting

Landform: Low flats and shallow depressions on outwash plains
Shape of areas: Irregular
Size of areas: 3 to 210 acres

Typical Profile

Kinross

Surface layer:
0 to 3 inches—black muck

Subsurface layer:
3 to 10 inches—grayish brown, mottled sand

Subsoil:
10 to 14 inches—dark reddish brown, partially cemented sand
14 to 22 inches—yellowish brown, mottled sand

Substratum:
22 to 80 inches—yellowish brown, mottled sand

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 11 inches—brown, mottled sand
11 to 42 inches—dark yellowish brown and yellowish brown, mottled sand

Substratum:
42 to 80 inches—brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Kinross—very poorly drained; Au Gres—somewhat poorly drained
Seasonal high water table: Kinross—apparent, 1.0 foot above to 1.0 foot below the surface at some time from September through June; Au Gres—apparent, 0.5 foot to 1.5 feet below the surface at some time from October through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Kinross—moderate; Au Gres—severe
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Kinross and similar soils: 50 to 70 percent
Au Gres and similar soils: 30 to 50 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The very poorly drained Leafriver and Tawas soils in landscape positions similar to those of the Kinross soil

Similar inclusions:
- Areas where the subsoil is lighter in color
- Soils that are moderately well drained

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- The formation of deep ruts can be prevented by using heavy equipment only when the soils are relatively dry, are frozen, or have an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed in areas of the Kinross soil to maintain the natural drainage system.
- Log landings are generally available on the Au Gres soil during the preferred operating season.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.
- Trees are generally not planted on the Kinross soil because of wetness, severe seedling mortality, and plant competition.
- Trees that can withstand seasonal wetness should be selected for planting on the Au Gres soil.
- Competing vegetation can be controlled by mechanical or chemical means.

Buildings

Major management concerns: Kinross—ponding; Au Gres—seasonal wetness
Management considerations:
- Because of ponding, the Kinross soil is generally unsuited to building site development.
- In areas of the Au Gres soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Kinross—ponding; Au Gres—seasonal wetness, rapid permeability
Management considerations:
- Because of ponding, the Kinross soil is generally unsuited to septic tank absorption fields.
- Because of the high water table, the Au Gres soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Kinross—6w; Au Gres—4w
Forestland ordination symbol: Kinross—2W; Au Gres—6W
Michigan soil management group: Kinross—5c-a; Au Gres—5b

25B—Kent sandy loam, 0 to 6 percent slopes

Setting

Landform: Nearly level and undulating end moraines
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray sandy loam

Subsoil:
6 to 13 inches—brown clay surrounded by grayish brown loam
13 to 22 inches—brown clay

Substratum:
22 to 28 inches—light brown silty clay
28 to 60 inches—light brown, mottled silty clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched, 2.0 to 3.5 feet below the surface at some time in October and November from and March through May
Surface runoff class: High
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: High
Potential for frost action: Moderate

Composition

Kent and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Morganlake soils in landscape positions similar to those of the Kent soil
- The poorly drained Angelica soils in depressions
- The very poorly drained Wakeley soils in depressions

Similar inclusions:
- Soils with a surface layer of fine sandy loam or loam
- Soils with less clay in the subsoil or substratum

Use and Management

Land use: Dominant use—cropland; other uses—pasture, forestland, and building site development

Cropland

Major management concerns: Water erosion, slow permeability, tilth of the surface layer
Management considerations:
- Crop residue management and a cropping sequence that includes close-growing crops help to control water erosion.
- Because of slow permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concerns: Compaction, overgrazing
Management considerations:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, windthrow hazard, plant competition
Management considerations:
- Because of the slow permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Shrink-swell potential, frost action, wetness
Management considerations:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Major management concerns: Slow permeability, wetness
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: 7C
Michigan soil management group: 1a

25C—Kent sandy loam, 6 to 12 percent slopes

Setting

Landform: Hill slopes on end moraines
Shape of areas: Irregular
Size of areas: 10 to 80 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray sandy loam

Subsoil:
6 to 13 inches—brown clay surrounded by grayish brown loam
13 to 22 inches—brown clay

Substratum:
22 to 28 inches—light brown silty clay
28 to 60 inches—light brown, mottled silty clay

Soil Properties and Qualities

Permeability: Slow
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched, 2.0 to 3.5 feet below the surface at some time in October and November and from March through May
Surface runoff class: Very high
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: High
Potential for frost action: Moderate

Composition

Kent and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Morganlake soils in landscape positions similar to those of the Kent soil
- The poorly drained Angelica soils in depressions
- The very poorly drained Wakeley soils in depressions

Similar inclusions:
- Soils with a surface layer of fine sandy loam or loam
- Soils with less clay in the subsoil or substratum

Use and Management

Land use: Dominant use—cropland; other uses—pasture, forestland, and building site development

Cropland

Major management concerns: Water erosion, nutrient loss, slow permeability, tilth of the surface layer
Management considerations:
- Inclusion of close-growing crops in the cropping sequence, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Conservation tillage, contour farming, cover crops, and sod-based crop rotations minimize the detachment and loss of nutrients associated with sedimentation, thus reducing the losses of solid-phase nitrogen and phosphorus.
- Because of slow permeability, subsurface drains should be narrowly spaced.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concerns: Compaction, overgrazing
Management considerations:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, windthrow hazard, plant competition
Management considerations:
- Because of the slow permeability and the sticky and plastic subsoil, logging roads should be graveled and in some areas landings should be stabilized.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Shrink-swell potential, frost action, wetness, slope
Management considerations:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Slow permeability, wetness, slope
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Land shaping and installing the distribution lines across the slope help to ensure that the absorption field functions properly.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 7C
Michigan soil management group: 1a

28B—East Lake sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, in outwash channels, and on stream terraces
Shape of areas: Irregular
Size of areas: 10 to 300 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark brown sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 8 inches—brown sand
8 to 31 inches—strong brown, yellowish brown, and brownish yellow sand
31 to 35 inches—yellowish brown very gravelly loamy coarse sand

Substratum:
35 to 80 inches—light yellowish brown, stratified very gravelly coarse sand and coarse sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

East Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in depressions

Similar inclusions:
- Soils that have a loamy layer in the subsoil
- Soils that have a surface layer of loamy sand
- Soils that have less gravel in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality

Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 2S
Michigan soil management group: 5a

28C—East Lake sand, 6 to 12 percent slopes

Setting

Landform: Low ridges and knolls on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark brown sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 8 inches—brown sand
8 to 31 inches—strong brown, yellowish brown, and brownish yellow sand
31 to 35 inches—yellowish brown very gravelly loamy coarse sand

Substratum:
35 to 80 inches—light yellowish brown, stratified very gravelly coarse sand and coarse sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

East Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in the lower landscape positions
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have a loamy layer in the subsoil
- Soils that have a surface layer of loamy sand
- Soils that have less gravel in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special

nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 2S
Michigan soil management group: 5a

28E—East Lake sand, 12 to 35 percent slopes

Setting

Landform: Ridges and escarpments on outwash plains
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark brown sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 8 inches—brown sand
8 to 31 inches—strong brown, yellowish brown, and brownish yellow sand
31 to 35 inches—yellowish brown very gravelly loamy coarse sand

Substratum:
35 to 80 inches—light yellowish brown, stratified very gravelly coarse sand and coarse sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

East Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils in the lower landscape positions

Similar inclusions:
- Soils that have a loamy layer in the subsoil
- Soils that have less gravel in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- The risk of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because loose sand can interfere with the traction of

wheeled equipment, logging roads should be stabilized.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Southern exposures may have higher seedling mortality rates than northern exposures.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, rapid permeability
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 2R
Michigan soil management group: 5a

32B—Kellogg sand, 0 to 6 percent slopes

Setting

Landform: Lake plains
Slope: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 5 to 45 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 11 inches—pinkish gray sand

Subsoil:
11 to 17 inches—dark reddish brown sand
17 to 33 inches—strong brown and dark brown sand
33 to 36 inches—reddish brown, mottled silty clay surrounded by brown loamy sand
36 to 43 inches—reddish brown, mottled silty clay

Substratum:
43 to 52 inches—reddish brown, mottled silty clay
52 to 80 inches—brown and light brown silty clay

Soil Properties and Qualities

Permeability: Rapid in the sandy material and very slow in the clayey material
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: Perched, 2.5 to 3.5 feet below the surface at some time from September through November and from March through May
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: High
Potential for frost action: Low

Composition

Kellogg and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The poorly drained Angelica soils in depressions and drainageways
- The very poorly drained Wakeley soils in depressions

Similar inclusions:
- Soils that are somewhat poorly drained

Use and Management

Land use: Dominant use—cropland; other uses—forestland, pasture, and building site development

Cropland

Major management concerns: Soil blowing, seasonal wetness
Management considerations:
- Conservation tillage, windbreaks, crop residue management, stripcropping, vegetative barriers, cover crops, and crop rotations that include small grain and hay help to control soil blowing. A permanent plant cover also helps to control soil blowing.
- Subsurface drains can reduce the wetness if a suitable outlet is available.

Pasture

Major management concern: Overgrazing

Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, seedling mortality, plant competition
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting seedlings that can withstand droughty conditions reduce the seedling mortality rate. Replanting is needed in some areas.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Wetness, shrink-swell potential
Management considerations:
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling.

Septic tank absorption fields

Major management concerns: Seasonal wetness, very slow permeability, a poor filtering capacity
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 3s
Forestland ordination symbol: 3S
Michigan soil management group: 4/1a

33B—Mancelona loamy sand, 0 to 6 percent slopes

Setting

Landform: Outwash plains, kame terraces, and stream terraces
Shape of areas: Irregular
Size of areas: 50 to 1,500 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—pinkish gray loamy sand

Subsoil:
3 to 15 inches—brown loamy sand
15 to 25 inches—brown gravelly sand
25 to 31 inches—strong brown gravelly loamy sand
31 to 36 inches—dark brown very gravelly loamy sand

Substratum:
36 to 80 inches—stratified, light brown very gravelly sand and pink sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil and very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Gladwin soils in depressions
- The well drained Mossback soils in landscape positions similar to those of the Mancelona soil

Similar inclusions:
- Soils that are sandy skeletal
- Soils that do not have a loamy layer in the subsoil
- Soils that have a sandy substratum

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.
- Adjusting the rate of water application to the available water capacity, the water intake rate, and the needs of the crop can help to prevent overirrigating and excessive leaching of plant nutrients.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: None

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Very rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 3s
Forestland ordination symbol: 3A
Michigan soil management group: 4a

33C—Mancelona loamy sand, 6 to 12 percent slopes

Setting

Landform: Low ridges and knolls on outwash plains, kame terraces, stream terraces, and moraines
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—pinkish gray loamy sand

Subsoil:
3 to 15 inches—brown loamy sand
15 to 25 inches—brown gravelly sand
25 to 31 inches—strong brown gravelly loamy sand
31 to 36 inches—dark brown very gravelly loamy sand

Substratum:
36 to 80 inches—stratified, light brown very gravelly sand and pink sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil and very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Gladwin soils in depressions

• The well drained Mossback soils in landscape positions similar to those of the Mancelona soil

Similar inclusions:
• Soils that do not have a loamy layer in the subsoil
• Soils that do not have a very gravelly substratum

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss
Management considerations:
• A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
• Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
• Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: None

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
• Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Very rapid permeability, slope
Management considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: 3A
Michigan soil management group: 4a

33D—Mancelona loamy sand, 12 to 18 percent slopes

Setting

Landform: Ridges and knolls on stream terraces, kame terraces, outwash plains, and moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—pinkish gray loamy sand

Subsoil:
3 to 15 inches—brown loamy sand
15 to 25 inches—brown gravelly sand
25 to 31 inches—strong brown gravelly loamy sand
31 to 36 inches—dark brown very gravelly loamy sand

Substratum:
36 to 80 inches—stratified, light brown very gravelly sand and pink sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil and very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Bamfield and Mossback soils in landscape positions similar to those of the Mancelona soil

Similar inclusions:
- Soils that do not have a loamy layer in the subsoil
- Soils that do not have a very gravelly substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: None

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.

Septic tank absorption fields

Major management concerns: Very rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 3A
Michigan soil management group: 4a

33E—Mancelona loamy sand, 18 to 35 percent slopes

Setting

Landform: Hills, ridges, and escarpments on kames and moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—pinkish gray loamy sand

Subsoil:
3 to 15 inches—brown loamy sand
15 to 25 inches—brown gravelly sand
25 to 31 inches—strong brown gravelly loamy sand
31 to 36 inches—dark brown very gravelly loamy sand

Substratum:
36 to 80 inches—stratified, light brown very gravelly sand and pink sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil and very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The well drained Bamfield and Mossback soils in landscape positions similar to those of the Mancelona soil

Similar inclusions:
- Soils that do not have a loamy layer in the subsoil
- Soils that do not have a very gravelly substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, erosion hazard
Management considerations:
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, very rapid permeability
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7e
Forestland ordination symbol: 3R
Michigan soil management group: 4a

47D—Graycalm sand, 6 to 18 percent slopes

Setting

Landform: Knolls and ridges on pitted outwash plains and moraines
Shape of areas: Irregular
Size of areas: 3 to 100 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 19 inches—brownish yellow and yellowish brown sand
19 to 80 inches—yellowish brown sand with thin bands of strong brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Graycalm and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in the lower landscape positions

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil
- Soils that have calcareous sand and gravel in the substratum
- Soils that have a darker subsoil
- Soils that do not have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of

wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 6S
Michigan soil management group: 5a

47F—Graycalm sand, 18 to 45 percent slopes

Setting

Landform: Hills, ridges, and escarpments on pitted outwash plains, kames, and moraines
Shape of areas: Irregular
Size of areas: 3 to 60 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 19 inches—brownish yellow and yellowish brown sand
19 to 80 inches—yellowish brown sand with thin bands of strong brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Graycalm and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil
- Soils that have calcareous sand and gravel in the substratum
- Soils that have a darker subsoil
- Soils that do not have bands of loamy sand in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Small areas of nearly level included soils, if any are

available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The risk of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- Southern exposures may have higher seedling mortality rates than northern exposures.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, rapid permeability
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 6R
Michigan soil management group: 5a

49B—Kalkaska sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains and end moraines
Shape of areas: Irregular
Size of areas: 3 to 1,600 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed forest litter

Surface layer:
1 to 3 inches—black and pinkish gray sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 12 inches—dark reddish brown sand
12 to 41 inches—brown, strong brown, and yellowish brown sand

Substratum:
41 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Kalkaska and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in the slightly lower landscape positions
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have thin bands of loamy sand in the subsoil or substratum
- Soils that have bands of gravelly sand in the substratum
- Soils that have lighter colored subsoil

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Timing fertilizer applications so that they meet crop nutrient needs, using split fertilizer applications, and

applying the fertilizer in bands reduce the risk of nutrient leaching.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.
- Adjusting the rate of water application to the available water capacity, the water intake rate, and the needs of the crop can help to prevent overirrigating and excessive leaching of plant nutrients.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 3S
Michigan soil management group: 5a

50B—Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes

Setting

Landform: Flats, shallow depressions, and low knolls adjacent to drainageways and swamps on outwash plains
Shape of areas: Irregular
Size of areas: 3 to 60 acres

Typical Profile

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 42 inches—brown, dark yellowish brown, and yellowish brown, mottled sand

Substratum:
42 to 80 inches—brown sand

Kinross

Surface layer:
0 to 3 inches—black muck

Subsurface layer:
3 to 10 inches—grayish brown, mottled sand

Subsoil:
10 to 14 inches—dark reddish brown, partially cemented sand
14 to 22 inches—yellowish brown, mottled sand

Substratum:
22 to 60 inches—yellowish brown, mottled sand

Croswell

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 27 inches—brown and strong brown sand
27 to 40 inches—brownish yellow, mottled sand

Substratum:
40 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Au Gres—somewhat poorly drained;

Kinross—poorly drained; Croswell—moderately well drained

Seasonal high water table: Au Gres—apparent, 0.5 foot to 1.5 feet below the surface at some time from October through June; Kinross—apparent, 1.0 foot above to 1.0 foot below the surface at some time from September through June; Croswell—apparent, 2.0 to 3.5 feet below the surface at some time from October through December and from March through June

Surface runoff class: Negligible

Flooding: None

Hazard of water erosion: Slight

Hazard of soil blowing: Au Gres and Croswell—severe; Kinross—moderate

Shrink-swell potential: Low

Potential for frost action: Croswell—low; Au Gres and Kinross—moderate

Composition

Au Gres and similar soils: 30 to 50 percent
Kinross and similar soils: 25 to 35 percent
Croswell and similar soils: 15 to 30 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The very poorly drained Leafriver and Tawas soils in landscape positions similar to those of the Kinross soil
- The excessively drained Grayling and Rubicon soils in the higher landscape positions

Similar inclusions:
- Areas where the subsoil is lighter in color
- Areas near the Croswell soil where the seasonal high water table is at a depth of 3.5 to 5.0 feet

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition

Management considerations:
- The formation of deep ruts can be prevented by using heavy equipment only when the Au Gres and Kinross soils are relatively dry, are frozen, or have an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed in areas of the Kinross soil to maintain the natural drainage system.
- Loose sand, especially on the Croswell soil, can interfere with the traction of wheeled equipment, especially during dry periods. Year-round logging roads should be stabilized.
- Log landings are generally available on the Au Gres and Croswell soils during the preferred operating season.
- Trees that can withstand seasonal wetness should be selected for planting on the Au Gres soil.
- Planting seedlings when the Croswell soil is moist and planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.
- Trees are generally not planted on the Kinross soil because of wetness, severe seedling mortality, and plant competition.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced.
- Competing vegetation can be controlled by mechanical or chemical means.

Buildings

Major management concerns: Au Gres and Croswell—caving of cutbanks, seasonal wetness; Kinross—ponding

Management considerations:
- Because cutbanks in areas of the Au Gres and Croswell soils are unstable and subject to caving, trench walls should be reinforced.
- In areas of the Au Gres and Croswell soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because of ponding, the Kinross soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Au Gres and Croswell—seasonal wetness, rapid permeability; Kinross—ponding

Management considerations:
- Because of the high water table, the Au Gres soil is generally unsuited to septic tank absorption fields.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in the Croswell soil.
- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Because of ponding, the Kinross soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Au Gres—4w; Kinross—6w; Croswell—4s
Forestland ordination symbol: Au Gres—6W; Kinross—2W; Croswell—5S
Michigan soil management group: Au Gres—5b; Kinross—5c-a; Croswell—5a

51—Tawas-Leafriver mucks

Setting

Landform: Depressions and drainageways on outwash plains
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to more than 330 acres

Typical Profile

Tawas

Surface layer:
0 to 9 inches—black muck

Subsoil:
9 to 24 inches—black and very dark gray muck

Substratum:
24 to 80 inches—dark gray sand

Leafriver

Surface layer:
0 to 9 inches—black muck

Subsurface layer:
9 to 11 inches—very dark gray mucky sand

Substratum:
11 to 15 inches—dark grayish brown, mottled sand
15 to 80 inches—grayish brown, mottled sand

Soil Properties and Qualities

Permeability: Tawas—moderately slow to moderately rapid in the organic material and rapid in the underlying sandy material; Leafriver—moderate or moderately rapid in the organic material and rapid in the underlying sandy material
Available water capacity: Tawas—high; Leafriver—moderate
Drainage class: Very poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface throughout the year
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Composition

Tawas and similar soils: 35 to 60 percent
Leafriver and similar soils: 25 to 50 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres and very poorly drained Deford soils in the slightly higher landscape positions

Similar inclusions:
- Small areas where the organic material is less than 8 inches or more than 50 inches thick
- Soils that have thin layers of very gravelly sand in the substratum
- Areas near the Leafriver soil where the substratum has 10 to 35 percent gravel

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on these soils.

Buildings

Major management concern: Ponding
Management considerations:
- Because of ponding, these soils are generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding

Management considerations:
- Because of ponding, these soils are generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w
Forestland ordination symbol: Tawas—5W; Leafriver—2W
Michigan soil management group: Tawas—M/4c; Leafriver—5c

52B—Blue Lake loamy sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 3 to more than 1,000 acres

Typical Profile

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Blue Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Feldhauser and Ossineke soils in landscape positions similar to those of the Blue Lake soil
- The excessively drained Rubicon soils in landscape positions similar to those of the Blue Lake soil

Similar inclusions:
- Soils in which bands of loamy sand or sandy loam in the lower part of the subsoil have a total thickness of less than 6 inches
- Areas where the upper part of the subsoil is lighter in color

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.
- Adjusting the rate of water application to the available water capacity, the water intake rate, and the needs of the crop can help to prevent overirrigating and excessive leaching of plant nutrients and pesticides.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: 3s
Forestland ordination symbol: 3A
Michigan soil management group: 4a

52D—Blue Lake loamy sand, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on moraines and outwash plains
Shape of areas: Irregular
Size of areas: 3 to 90 acres

Typical Profile

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight or moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Blue Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Rubicon soils and the well drained, loamy Bamfield soils in landscape positions similar to those of the Blue Lake soil

Similar inclusions:
- Soils in which bands of loamy sand or sandy loam in the lower part of the subsoil have a total thickness of less than 6 inches
- Areas where the upper part of the subsoil is lighter in color

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 3A
Michigan soil management group: 4a

52E—Blue Lake loamy sand, 18 to 35 percent slopes

Setting

Landform: Hills and ridges on moraines
Shape of areas: Irregular
Size of areas: 3 to 90 acres

Typical Profile

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Blue Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Rubicon soils in landscape positions similar to those of the Blue Lake soil

Similar inclusions:
- Soils in which bands of loamy sand or sandy loam in the lower part of the subsoil have a total thickness of less than 6 inches
- Areas where the upper part of the subsoil is lighter in color

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, plant competition
Management considerations:
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concern: Slope
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Slope

Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7e
Forestland ordination symbol: 3R
Michigan soil management group: 4a

64B—Feldhauser fine sandy loam, 0 to 6 percent slopes

Setting

Landform: Flats and depressions on moraines
Shape of areas: Irregular
Size of areas: 3 to 340 acres

Typical Profile

Surface layer:
0 to 10 inches—dark grayish brown fine sandy loam

Subsoil:
10 to 32 inches—dark yellowish brown and yellowish brown fine sandy loam
32 to 37 inches—yellowish brown fine sandy loam and dark yellowish brown sandy loam
37 to 45 inches—dark yellowish brown, mottled sandy loam
45 to 80 inches—brown sand with bands of dark yellowish brown loamy sand

Soil Properties and Qualities

Permeability: Moderate in the loamy material and rapid in the underlying sandy material
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched, 2.0 to 3.5 feet below the surface at some time in October and April
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Feldhauser and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Blue Lake and somewhat excessively drained Kalkaska soils in landscape positions similar to those of the Feldhauser soil

Similar inclusions:
- Soils that have less than 20 inches of loamy material overlying the sand
- Areas where the subsoil is redder

Use and Management

Land use: Dominant use—cropland; other uses—pasture, forestland, and building site development

Cropland

Major management concerns: Water erosion, soil blowing, tilth of the surface layer
Management considerations:
- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concerns: Compaction, seasonal wetness
Management considerations:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

Forestland

Major management concerns: Equipment limitations, plant competition
Management considerations:
- Skidders should not be used during wet periods, when ruts form easily.
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concerns: Caving of cutbanks, wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concern: Wetness
Management considerations:
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: 2e
Forestland ordination symbol: 3A
Michigan soil management group: 3a

65F—Rubicon sand, 8 to 50 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on outwash plains and moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 3 to 200 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 4 inches—grayish brown sand

Subsoil:
4 to 31 inches—brown, dark yellowish brown, and brownish yellow sand

Substratum:
31 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Rubicon and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Au Gres soils in depressions
- The moderately well drained Croswell soils

Similar inclusions:
- Areas where the subsoil is lighter in color
- Soils that have bands of gravelly sand in the substratum
- Soils that have thin bands of loamy sand in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because of the slope, most areas of this soil are unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, rapid permeability
Management considerations:
- Because of the slope, most areas of this soil are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 4R
Michigan soil management group: 5.3a

75B—Rubicon sand, 0 to 6 percent slopes

Setting

Landform: Flats or low knolls on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 3 to more than 5,000 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 4 inches—grayish brown sand

Subsoil:
4 to 31 inches—brown, dark yellowish brown, and brownish yellow sand

Substratum:
31 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Rubicon and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in landscape positions similar to or slightly lower than those of the Rubicon soil

Similar inclusions:
- Areas where the subsoil is lighter in color
- Areas where the subsoil is darker
- Soils that have bands of gravelly sand in the substratum
- Soils that have thin bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—forestland (fig. 10); other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of

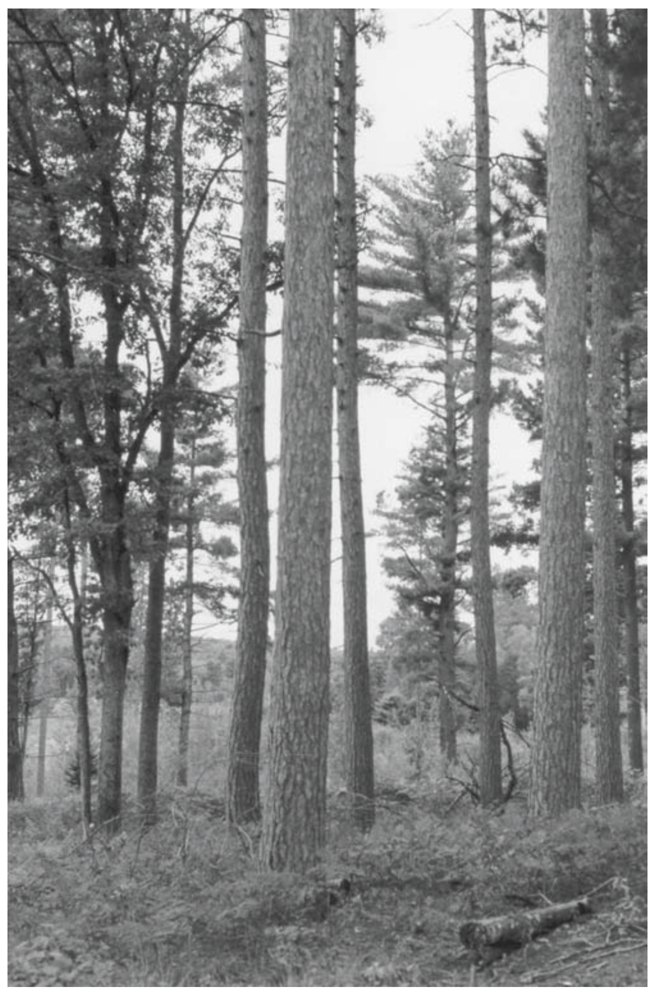

Figure 10.—A mature stand of red pine on Rubicon sand, 0 to 6 percent slopes.

wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 4S
Michigan soil management group: 5.3a

75D—Rubicon sand, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on stream terraces, outwash plains, and moraines
Shape of areas: Irregular or linear
Size of areas: 3 to 70 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 4 inches—grayish brown sand

Subsoil:
4 to 31 inches—brown, dark yellowish brown, and brownish yellow sand

Substratum:
31 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Rubicon and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in shallow depressions
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Areas where the subsoil is lighter in color
- Areas where the subsoil is darker
- Soils that have bands of gravelly sand in the substratum
- Soils that have thin bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.

• Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
• Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
• Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
• Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
• Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
• The poor filtering capacity of this soil can result in the pollution of ground water.
• On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
• Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 4S
Michigan soil management group: 5.3a

75E—Rubicon sand, 18 to 35 percent slopes

Setting

Landform: Hill slopes and escarpments on outwash plains and moraines
Shape of areas: Irregular or linear
Size of areas: 3 to 70 acres

Typical Profile

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 4 inches—grayish brown sand

Subsoil:
4 to 31 inches—brown, dark yellowish brown, and brownish yellow sand

Substratum:
31 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Rubicon and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The moderately well drained Croswell soils
• The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
• Areas where the subsoil is lighter in color
• Soils that have bands of gravelly sand in the substratum
• Soils that have thin bands of loamy sand in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
• The risk of erosion can be reduced by seeding logging roads, landings, and areas that have been

cut and filled and by installing water bars and culverts.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 4R
Michigan soil management group: 5.3a

78—Pits, borrow

Setting

This map unit is in areas that have been excavated for gravel, sand, and fill material. Some areas have been excavated below the seasonal high water table and are ponded. A few of the pits have small deposits of rubbish and trash. Areas of this unit are irregular in shape and range from 5 to 150 acres in size.

Composition

Pits: 100 percent

Use and Management

Land use: Source of gravel, sand, or fill material
Management considerations:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Forestland ordination symbol: None assigned
Michigan soil management group: None assigned

81B—Grayling sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains
Shape of areas: Irregular
Size of areas: 50 to 2,000 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 27 inches—dark yellowish brown and yellowish brown sand

Substratum:
27 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Grayling and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in the lower landscape positions
- The very poorly drained Dawson and Loxley soils in closed depressions

Similar inclusions:
- Soils that have bands of loamy sand in the substratum
- Soils that have very gravelly sand in the substratum

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concern: Caving of cutbanks
Management measures:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 4S
Michigan soil management group: 5.7a

81D—Grayling sand, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on outwash plains, some of which are pitted
Shape of areas: Irregular or linear
Size of areas: 3 to 640 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 27 inches—dark yellowish brown and yellowish brown sand

Substratum:
27 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Grayling and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils
- The somewhat poorly drained Au Gres soils in depressions
- The very poorly drained Dawson and Loxley soils in closed depressions

Similar inclusions:
- Soils that have bands of fine sand or gravelly sand in the subsoil or substratum
- Soils that have free carbonates in the substratum

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 4S
Michigan soil management group: 5.7a

81E—Grayling sand, 18 to 35 percent slopes

Setting

Landform: Outwash plains and deltas
Shape of areas: Irregular
Size of areas: 3 to 30 acres

Typical Profile

Surface layer:
0 to 5 inches—black sand

Subsoil:
5 to 17 inches—yellowish red sand

Substratum:
17 to 80 inches—brownish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Grayling and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in depressions and on edges adjoining areas of poorly drained soils

Similar inclusions:
- Soils with a darker subsoil
- Soils with carbonates in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, erosion hazard, seedling mortality
Management considerations:
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Planting when the soil is moist and planting seedlings that can withstand droughty conditions reduce the seedling mortality rate. Replanting is needed in some areas.
- Southern exposures may have higher seedling mortality rates than northern exposures.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Slope, a poor filtering capacity
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 4R
Michigan soil management group: 5.7a

81F—Grayling sand, 18 to 45 percent slopes

Setting

Landform: Hills, ridges, and escarpments on outwash plains, some of which are pitted
Shape of areas: Irregular or linear
Size of areas: 3 to 200 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsoil:
3 to 27 inches—dark yellowish brown and yellowish brown sand

Substratum:
27 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Grayling and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils along drainageways
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have bands of gravelly sand in the substratum
- Soils that have free carbonates in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- The risk of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Southern exposures may have higher seedling mortality rates than northern exposures.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, rapid permeability

Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 4R
Michigan soil management group: 5.7a

82B—Udorthents, loamy, nearly level and undulating

This map unit consists of loamy soils in areas where the surface layer and portions of the subsoil have been removed or disturbed. In some areas the original soil has been covered with loamy fill material. Most areas are barren or sparsely vegetated.

Setting

Landform: Flats and low knolls on moraines
Slope: 0 to 6 percent
Shape of areas: Irregular or rectangular
Size of areas: 3 to 300 acres

Typical Profile

0 to 60 inches—sandy loam to clay

Soil Properties and Qualities

Permeability: Moderate to slow
Available water capacity: Moderate
Drainage class: Well drained or moderately well drained
Seasonal high water table: At a depth of 3.0 to more than 6.5 feet
Surface runoff class: Negligible to very high
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low to high
Potential for frost action: Variable

Composition

Udorthents and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- Small areas of undisturbed soils
- Areas where the surface layer is sand

Similar inclusions:
- Areas where the surface layer is loamy sand
- Soils that have a sandy or gravelly substratum

Use and Management

Land use: Sites for oil and gas well drilling, sites for military training, or abandoned land
Management considerations:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Forestland ordination symbol: None assigned
Michigan soil management group: None assigned

83B—Udipsamments, nearly level and undulating

This map unit consists of sandy soils in areas where the surface layer and portions of the subsoil have been removed or disturbed. In some areas the original soil has been covered with sandy fill material. Most areas are barren or sparsely vegetated.

Setting

Landform: Flats and low knolls on outwash plains, stream terraces, and moraines
Slope: 0 to 6 percent
Shape of areas: Irregular or rectangular
Size of areas: 3 to 300 acres

Typical Profile

0 to 60 inches—sand or loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Well drained to excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Udipsamments and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- Small areas of undisturbed soils
- Areas where the surface layer is sandy loam

Similar inclusions:
- Areas where the surface layer is loamy sand
- Soils that have thin bands of loamy sand, sandy loam, or gravelly sand below the surface layer

Use and Management

Land use: Sites for oil and gas well drilling, sites for military training, or abandoned land
Management considerations:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: None assigned
Forestland ordination symbol: None assigned
Michigan soil management group: None assigned

86—Histosols and Aquents, ponded

Setting

Landform: Depressions on moraines, outwash plains, and flood plains
Slope: 0 percent
Shape of areas: Oval, elongated, or irregular
Size of areas: 5 to 100 acres

Soil Properties and Qualities

Texture: Histosols—muck; Aquents—sandy or loamy material
Permeability: Moderately rapid to moderately slow
Available water capacity: Low to high
Drainage class: Very poorly drained
Seasonal high water table: Apparent, at the surface to 1 foot above the surface throughout the year
Surface runoff class: Negligible
Flooding: None to frequent
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: Low to high
Potential for frost action: High

Composition

Histosols: 0 to 100 percent
Aquents: 0 to 100 percent
Contrasting inclusions: 0 to 5 percent

Contrasting Inclusions

- Small areas of poorly drained or somewhat poorly drained soils on islands

Use and Management

Land use: Wetland wildlife habitat
Management considerations:
- Onsite investigation is needed to determine the suitability for specific uses.

Interpretive Groups

Land capability classification: Aquents—6w; Histosols—5w
Forestland ordination symbol: None assigned
Michigan soil management group: None assigned

90B—Chinwhisker sand, 0 to 4 percent slopes

Setting

Landform: Flats or swales on outwash plains and stream terraces
Shape of areas: irregular
Size of areas: 3 to 110 acres

Typical Profile

Surface layer:
0 to 2 inches—intermixed black and light brownish gray sand

Subsurface layer:
2 to 11 inches—light brownish gray sand

Subsoil:
11 to 18 inches—dark brown sand
18 to 23 inches—yellowish brown sand
23 to 42 inches—light yellowish brown, mottled sand
42 to 58 inches—light yellowish brown, mottled sand with bands of dark yellowish brown loamy sand and sandy loam
58 to 80 inches—light yellowish brown, mottled sand with bands of yellowish brown loamy sand and sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Moderately well drained
Seasonal high water table: Apparent, 2.0 to 3.5 feet below the surface at some time from October through December and from March through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Chinwhisker and similar soils: 85 to 95 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Rubicon soils, which do not have bands in the subsoil and are in the slightly higher landscape positions
- The somewhat poorly drained Au Gres in swales
- The very poorly drained Deford soils in depressions and drainageways

Similar inclusions:
- Soils without bands of loamy sand in the subsoil
- Soils with a lighter colored subsoil
- Soils that are well drained
- Soils with mottles below a depth of 40 inches

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting seedlings that can withstand droughty conditions reduce the seedling mortality rate. Replanting is needed in some areas.

Buildings

Major management concerns: Caving of cutbanks, wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Wetness can be reduced by a drainage system around structures with basements and crawl spaces.

Septic tank absorption fields

Major management concerns: Rapid permeability, wetness
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 6S
Michigan soil management group: 5a

95D—Menominee loamy sand, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 8 inches—grayish brown loamy sand

Subsoil:
8 to 19 inches—dark brown and dark yellowish brown loamy sand
19 to 23 inches—light brownish gray loamy sand
23 to 27 inches—light brownish gray loamy sand surrounding reddish brown sandy clay loam
27 to 36 inches—reddish brown sandy clay loam

Substratum:
36 to 48 inches—reddish brown sandy clay loam
48 to 80 inches—light reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid in the sandy material and moderately slow in the underlying loamy material
Available water capacity: Moderate
Drainage class: Well drained

Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Moderate
Potential for frost action: Low

Composition

Menominee and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona and Bamfield soils in landscape positions similar to those of the Menominee soil
- The moderately well drained Ossineke and Morganlake soils
- The poorly drained Angelica soils in depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of sand

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management measures:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management measures:
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Caving of cutbanks, slope
Management measures:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management measures:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 6A
Michigan soil management group: 4/2a

95E—Menominee loamy sand, 18 to 35 percent slopes

Setting

Landform: Hills, ridges, and escarpments on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 8 inches—grayish brown loamy sand

Subsoil:
8 to 19 inches—dark brown and dark yellowish brown loamy sand
19 to 23 inches—light brownish gray loamy sand
23 to 27 inches—light brownish gray loamy sand surrounding reddish brown sandy clay loam
27 to 36 inches—reddish brown sandy clay loam

Substratum:
36 to 48 inches—reddish brown sandy clay loam
48 to 80 inches—light reddish brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid in the sandy material and moderately slow in the underlying loamy material
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None

Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Moderate
Potential for frost action: Low

Composition

Menominee and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona and Bamfield soils in landscape positions similar to those of the Menominee soil
- The poorly drained Angelica soils in closed depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of sand

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, plant competition
Management considerations:
- Because of the slope, special care is needed in laying out the logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Species preference can be managed by selective cutting.

Buildings

Major management concern: Slope
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6e
Forestland ordination symbol: 6R
Michigan soil management group: 4/2a

113—Angelica loam

Setting

Landform: Depressions and drainageways on moraines
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 35 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray loam

Subsoil:
8 to 10 inches—grayish brown, mottled loam
10 to 20 inches—reddish brown, mottled clay loam

Substratum:
20 to 38 inches—brown, mottled clay loam
38 to 60 inches—reddish brown, mottled clay loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: High
Drainage class: Poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface at some time from September through June
Surface runoff class: Medium
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate
Potential for frost action: High

Composition

Angelica and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Ossineke and well drained Bamfield soils on uplands

Similar inclusions:
- Soils that have an organic surface layer
- Sandy soils that are poorly drained
- Somewhat poorly drained soils

Use and Management

Land use: Dominant use—forestland; other uses—cropland and pasture

Forestland

Major management concerns: Equipment limitations, windthrow hazard, seedling mortality, plant competition
Management considerations:
- The seasonal high water table restricts the use of equipment to midsummer, when the soil is dry, or midwinter, when the soil is frozen or has an adequate snow cover.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.

Cropland

Major management concerns: Seasonal wetness, tilth of the surface layer
Management considerations:
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concern: Compaction
Management considerations:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concern: Ponding
- Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 5w
Forestland ordination symbol: 7W
Michigan soil management group: 2.5c

115D—Kalkaska sand, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on outwash plains and moraines
Shape of areas: Irregular or linear
Size of areas: 3 to 120 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed forest litter

Surface layer:
1 to 3 inches—black and pinkish gray sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 12 inches—dark reddish brown sand
12 to 41 inches—brown, strong brown, and yellowish brown sand

Substratum:
41 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight

Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Kalkaska and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have thin bands of loamy sand in the subsoil or substratum
- Soils that have bands of gravelly sand in the substratum
- Soils that have a lighter colored subsoil

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 3S
Michigan soil management group: 5a

116B—Mancelona sand, 0 to 6 percent slopes

Setting

Landform: Outwash plains, moraines, and stream terraces
Shape of areas: Irregular
Size of areas: 3 to 200 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—pinkish gray sand

Subsoil:
6 to 16 inches—dark brown sand
16 to 29 inches—yellowish brown and light yellowish brown sand
29 to 35 inches—reddish brown gravelly sandy loam

Substratum:
35 to 80 inches—yellowish brown, calcareous very gravelly sand

Soil Properties and Qualities

Permeability: Moderately rapid in the surface layer and subsoil and very rapid in the substratum
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet

Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Ossineke soils, which are loamy throughout and are in landscape positions similar to those of the Mancelona soil
- The moderately well drained Morganlake soils, which are sandy in the upper part and loamy in the lower part and are in landscape positions similar to those of the Mancelona soil
- The somewhat poorly drained Gladwin soils in depressions

Similar inclusions:
- Soils in which the very gravelly substratum is at a depth of more than 40 inches
- Soils that do not have a layer of sandy loam in the subsoil
- Soils that have lighter colored subsoil
- Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, plant competition
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting seedlings that can withstand droughty conditions reduce the seedling mortality rate. Replanting is needed in some areas.
- Special harvest methods may be needed to control undesirable plants.
- Competing vegetation generally can be controlled by mechanical means.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Very rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 3s
Forestland ordination symbol: 3S
Michigan soil management group: 4a

126F—Udipsamments-Haplorthods-Glossudalfs complex, nearly level to steep

This map unit is used as an artillery and bombing range by the National Guard. In areas of this unit, pits or craters formed by exploding bombs, artillery shells, rockets, or mortar shells are surrounded undisturbed soils. Because of repetitive explosions and fire, many areas are sparsely vegetated with grasses and forbs. Areas outside of the concentrated target points still maintain a forest cover.

Setting

Landform: Variable
Slope: 0 to 45 percent
Shape of areas: Irregular
Size of areas: 13 to 7,010 acres

Typical Profile

Udipsamments

0 to 60 inches—sand and loamy sand

Haplorthods

0 to 60 inches—variable

Glossudalfs

0 to 60 inches—variable

Soil Properties and Qualities

Permeability: Udipsamments—rapid; Haplorthods and Glossudalfs—variable
Available water capacity: Udipsamments—low; Haplorthods and Glossudalfs—variable
Drainage class: Udipsamments—excessively drained or somewhat excessively drained; Haplorthods and Glossudalfs—well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible to medium
Flooding: None
Hazard of water erosion: Variable
Hazard of soil blowing: Udipsamments—severe; Haplorthods and Glossudalfs—variable
Shrink-swell potential: Udipsamments—low; Haplorthods and Glossudalfs—variable
Potential for frost action: Udipsamments and Haplorthods—low; Glossudalfs—variable

Composition

Dominantly Udipsamments, Haplorthods, and Glossudalfs
Contrasting inclusions: Histosols and Aquents

Use and Management

Land use: Artillery and bombing range
Management considerations:
- This prohibited access area is generally too dangerous for other uses because unexploded ammunition may be present throughout the area.

Interpretive Groups

Land capability classification: None assigned
Forestland ordination symbol: None assigned
Michigan soil management group: None assigned

127—Cathro muck

Setting

Landform: Depressions and drainageways on moraines
Slope: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 150 acres

Typical Profile

Cathro

Surface layer:
0 to 22 inches—black and dark brown muck

Substratum:
22 to 27 inches—dark grayish brown, mottled sandy loam
27 to 38 inches—dark grayish brown, mottled clay loam
38 to 60 inches—brown, mottled clay loam

Soil Properties and Qualities

Permeability: Moderately slow to moderately rapid in the organic material and moderately slow or moderate in the underlying loamy material
Available water capacity: Very high
Drainage class: Very poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface throughout the year
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: High

Composition

Cathro and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Slade and moderately well drained Ossineke soils in the higher landscape positions

Similar inclusions:
- Soils with less than 16 inches of muck overlying the loamy material

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Log landings should be located on drier, better suited soils.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced

and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, severe seedling mortality, and plant competition, trees are generally not planted on this soil.

Buildings

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6w
Forestland ordination symbol: 5W
Michigan soil management group: M/3c

141B—Leelanau loamy sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on end moraines
Shape of areas: Irregular
Size of areas: 3 to 160 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 7 inches—light brownish gray sand

Subsoil:
7 to 21 inches—dark brown, brown, and dark yellowish brown sand
21 to 37 inches—yellowish brown sand surrounding brown sandy loam
37 to 52 inches—brown sandy loam

Substratum:
52 to 80 inches—brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Leelanau and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mossback soils in landscape positions similar to those of the Leelanau soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil
- Soils that have a sandy substratum

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.

Pasture

Major management concern: Seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing

vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: None

Interpretive Groups

Land capability classification: 3s
Forestland ordination symbol: 6A
Michigan soil management group: 4a

141C—Leelanau loamy sand, 6 to 12 percent slopes

Setting

Landform: Knolls and low ridges on moraines
Shape of areas: Irregular
Size of areas: 3 to 260 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 7 inches—light brownish gray sand

Subsoil:
7 to 21 inches—dark brown, brown, and dark yellowish brown sand
21 to 37 inches—yellowish brown sand surrounding brown sandy loam
37 to 52 inches—brown sandy loam

Substratum:
52 to 80 inches—brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Leelanau and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mossback soils in landscape positions similar to those of the Leelanau soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil
- Soils that have a sandy substratum

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, water erosion, soil blowing, a low content of organic matter
Management considerations:
- Inclusion of close-growing crops in the cropping sequence, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- .Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.

Pasture

Major management concern: Seasonal droughtiness
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition

Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: 6A
Michigan soil management group: 4a

141D—Leelanau loamy sand, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 3 to 260 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 7 inches—light brownish gray sand

Subsoil:
7 to 21 inches—dark brown, brown, and dark yellowish brown sand
21 to 37 inches—yellowish brown sand surrounding brown sandy loam
37 to 52 inches—brown sandy loam

Substratum:
52 to 80 inches—brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Leelanau and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mossback soils in landscape positions similar to those of the Leelanau soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil
- Soils that have a sandy substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Pasture

Major management concern: Seasonal droughtiness
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 3A
Michigan soil management group: 4a

146F—Rubicon-Graycalm sands, 8 to 50 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 3 to 200 acres

Typical Profile

Rubicon

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 31 inches—brown, dark yellowish brown, and brownish yellow sand

Substratum:
31 to 80 inches—light yellowish brown sand

Graycalm

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 2 inches—grayish brown sand

Subsoil:
2 to 19 inches—brownish yellow and yellowish brown sand
19 to 80 inches—yellowish brown sand with thin bands of strong brown loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Rubicon—excessively drained; Graycalm—somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Rubicon and similar soils: 60 to 80 percent
Graycalm and similar soils: 20 to 40 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil or substratum
- Soils that have a darker subsoil

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.

- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because of the slope, most areas of these soils are unsuited to building site development.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, most areas of these soils are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: Rubicon—4R; Graycalm—6R
Michigan soil management group: Rubicon—5.3a; Graycalm—5a

147B—Lindquist sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 3,000 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 3 inches—pinkish gray sand

Subsoil:
3 to 10 inches—dark brown sand
10 to 28 inches—strong brown and reddish yellow sand
28 to 79 inches—light brown sand with thin bands of brown sand and loamy sand
79 to 80 inches—pinkish gray sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Lindquist and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Chinwhisker soils in swales and along drainageways

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil
- Soils that do not have bands of loamy sand in the substratum
- Soils that have a lighter colored subsoil
- Soils that have calcareous sand and gravel in the substratum

Use and Management

Land use: Dominant use—forestland (fig. 11); other uses—cropland, pasture, and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Cropland

Major management concerns: Seasonal droughtiness,

Figure 11.—Scotch pine grown for Christmas trees on Lindquist sand, 0 to 6 percent slopes.

soil blowing, a low content of organic matter, nutrient and pesticide loss

Management considerations:

- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Timing fertilizer applications so that they meet crop nutrient needs, using split fertilizer applications, and applying the fertilizer in bands reduce the risk of nutrient leaching.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.
- Adjusting the rate of water application to the available water capacity, the water intake rate, and the needs of the crop can help to prevent overirrigating and excessive leaching of plant nutrients.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness

Management considerations:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concern: Caving of cutbanks

Management considerations:

- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability

Management considerations:

- The poor filtering capacity of this soil can result in the pollution of ground water.

- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 6S
Michigan soil management group: 5.3a

147C—Lindquist sand, 6 to 12 percent slopes

Setting

Landform: Low knolls and low ridges on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 2,000 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 3 inches—pinkish gray sand

Subsoil:
3 to 10 inches—dark brown sand
10 to 28 inches—strong brown and reddish yellow sand
28 to 79 inches—light brown sand with thin bands of brown sand and loamy sand
79 to 80 inches—pinkish gray sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Lindquist and similar soils: 90 to 100 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Chinwhisker soils in swales
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil
- Soils that have calcareous sand and gravel in the substratum
- Soils that do not have bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter

of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 6S
Michigan soil management group: 5.3a

147D—Lindquist sand, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 3 inches—pinkish gray sand

Subsoil:
3 to 10 inches—dark brown sand
10 to 28 inches—strong brown and reddish yellow sand
28 to 79 inches—light brown sand with thin bands of brown sand and loamy sand
79 to 80 inches—pinkish gray sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Lindquist and similar soils: 85 to 100 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Chinwhisker soils
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil
- Soils that have calcareous sand and gravel in the substratum
- Soils that do not have bands of loamy sand in the subsoil

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 6S
Michigan soil management group: 5.3a

147E—Lindquist sand, 18 to 35 percent slopes

Setting

Landform: Hills and ridges on kames and moraines
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 3 inches—pinkish gray sand

Subsoil:
3 to 10 inches—dark brown sand
10 to 28 inches—strong brown and reddish yellow sand
28 to 79 inches—light brown sand with thin bands of brown sand and loamy sand
79 to 80 inches—pinkish gray sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Lindquist and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Chinwhisker soils
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil
- Soils that have calcareous sand and gravel in the substratum
- Soils that do not have bands of loamy sand in the subsoil

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- If available, nearly level areas should be selected as sites for landings.
- The risk of erosion can be reduced by seeding logging roads, landings, and areas that have been cut and filled and by installing water bars and culverts.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 6R
Michigan soil management group: 5.3a

166A—Slade loam, 0 to 3 percent slopes

Setting

Landform: Shallow depressions on end moraines
Slope: 0 to 3 percent
Shape of areas: Irregular
Size of areas: 5 to 45 acres

Typical Profile

Surface layer:
0 to 10 inches—very dark brown loam

Subsoil:
10 to 12 inches—dark brown, mottled clay loam surrounded by brown sandy loam
12 to 21 inches—dark reddish brown and dark brown, mottled clay loam
21 to 28 inches—brown, mottled clay loam

Substratum:
28 to 36 inches—reddish brown, mottled loam
36 to 80 inches—brown loam

Soil Properties and Qualities

Permeability: Moderately slow
Available water capacity: Moderate
Drainage class: Somewhat poorly drained
Seasonal high water table: Perched, 0.5 foot to 2.5 feet below the surface at some time from October through May
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Slight
Shrink-swell potential: Moderate
Potential for frost action: High

Composition

Slade and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The poorly drained Angelica soils in depressions

Similar inclusions:
- Soils that are moderately well drained

Use and Management

Land use: Dominant use—cropland; other uses—forestland, pasture, and building site development

Cropland

Major management concerns: Seasonal wetness, tilth of the surface layer
Management considerations:
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concern: Compaction
Management considerations:
- Restricted grazing during wet periods helps to prevent compaction and poor tilth.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, windthrow hazard, plant competition
Management considerations:
- Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
- Skidders should not be used during wet periods, when ruts form easily.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Wetness, shrink-swell potential, frost action
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action.

Septic tank absorption fields

Major management concerns: Wetness, moderately slow permeability
Management considerations:
- Because of the high water table, this soil is generally unsuited to septic tank absorption fields.
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: 2w
Forestland ordination symbol: 3W
Michigan soil management group: 1.5b

197A—Gladwin loamy sand, 0 to 3 percent slopes

Setting

Landform: Shallow depressions on outwash plains and stream terraces; also, low knolls in swamps
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Surface layer:
0 to 4 inches—very dark gray loamy sand

Subsurface layer:
4 to 8 inches—grayish brown, mottled sand

Subsoil:
8 to 12 inches—brown, mottled sand
12 to 20 inches—dark yellowish brown, mottled gravelly loamy sand
20 to 25 inches—yellowish brown, mottled sand

Substratum:
25 to 80 inches—grayish brown and brown, mottled, stratified sand, gravelly sand, and very gravelly loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid in the upper part of the profile and very rapid in the lower part
Available water capacity: Low
Drainage class: Somewhat poorly drained
Seasonal high water table: Apparent, 0.5 foot to 1.5 feet below the surface at some time from October through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Gladwin and similar soils: 90 to 95 percent
Contrasting inclusions: 5 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Mancelona soils on low knolls and ridges
- The very poorly drained Leafriver soils in depressions

Similar inclusions:
- Sandy soils that are moderately well drained

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal wetness, tilth of the surface layer
Management considerations:
- Subsurface drains can reduce the wetness if a suitable outlet is available.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concern: Seasonal wetness
Management considerations:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants.

Forestland

Major management concerns: Equipment limitations, windthrow hazard, plant competition
Management considerations:
- Equipment should be used only when the soil is relatively dry or has an adequate snow cover.
- Trees that can withstand seasonal wetness should be selected for planting.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Caving of cutbanks, seasonal wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Wetness can be reduced by a drainage system around structures with basements and crawl spaces.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Very rapid permeability, seasonal wetness
Management considerations:
- Because of the high water table, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 3w
Forestland ordination symbol: 5W
Michigan soil management group: 4b

323B—East Lake-Rubicon sands, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 10 to 300 acres

Typical Profile

East Lake

Surface layer:
0 to 1 inch—very dark brown sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 8 inches—brown sand
8 to 18 inches—strong brown sand
18 to 31 inches—yellowish brown and brownish yellow sand

Substratum:
31 to 35 inches—yellowish brown very gravelly loamy coarse sand
35 to 80 inches—light yellowish brown, stratified very gravelly coarse sand and coarse sand

Rubicon

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 4 inches—grayish brown sand

Subsoil:
4 to 31 inches—brown, dark yellowish brown, and brownish yellow sand

Substratum:
31 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: East Lake—somewhat excessively drained; Rubicon—excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

East Lake and similar soils: 45 to 65 percent
Rubicon and similar soils: 25 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in landscape positions similar to or slightly lower than those of the East Lake and Rubicon soils
- The somewhat poorly drained Au Gres soils in depressions
- The very poorly drained Deford soils in depressions and drainageways

Similar inclusions:
- Soils that have a surface layer of loamy sand
- Areas where the subsoil is lighter in color
- Soils that have thin bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: East Lake—4s; Rubicon—6s
Forestland ordination symbol: East Lake—2S; Rubicon—4S
Michigan soil management group: East Lake—5a; Rubicon—5.3a

323C—East Lake-Rubicon sands, 6 to 12 percent slopes

Setting

Landform: Low ridges and knolls on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

East Lake

Surface layer:
0 to 1 inch—very dark brown sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 8 inches—brown sand
8 to 18 inches—strong brown sand
18 to 31 inches—yellowish brown and brownish yellow sand

Substratum:
31 to 35 inches—yellowish brown very gravelly loamy coarse sand
35 to 80 inches—light yellowish brown, stratified very gravelly coarse sand and coarse sand

Rubicon

Surface layer:
0 to 1 inch—very dark gray sand

Subsurface layer:
1 to 4 inches—grayish brown sand

Subsoil:
4 to 31 inches—brown, dark yellowish brown, and brownish yellow sand

Substratum:
31 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: East Lake—somewhat excessively drained; Rubicon—excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

East Lake and similar soils: 45 to 65 percent
Rubicon and similar soils: 25 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in landscape positions similar to or slightly lower than those of the East Lake and Rubicon soils
- The somewhat poorly drained Au Gres soils in depressions
- The very poorly drained Deford soils in depressions and drainageways

Similar inclusions:
- Soils that have a surface layer of loamy sand
- Areas where the subsoil is lighter in color
- Soils that have thin bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: East Lake—2S; Rubicon—4S
Michigan soil management group: East Lake—5a; Rubicon—5.3a

337B—Mancelona-East Lake complex, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains, kame terraces, and stream terraces
Shape of areas: Irregular
Size of areas: 10 to 300 acres

Typical Profile

Mancelona

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 3 inches—pinkish gray loamy sand

Subsoil:
3 to 15 inches—brown loamy sand
15 to 25 inches—brown gravelly sand
25 to 31 inches—strong brown gravelly loamy sand
31 to 36 inches—dark brown very gravelly loamy sand

Substratum:
36 to 80 inches—stratified, light brown very gravelly sand and pink sand

East Lake

Surface layer:
0 to 1 inch—very dark brown sand

Subsurface layer:
1 to 4 inches—brown sand

Subsoil:
4 to 8 inches—brown sand
8 to 18 inches—strong brown sand
18 to 31 inches—yellowish brown and brownish yellow sand

Substratum:
31 to 35 inches—yellowish brown very gravelly loamy coarse sand
35 to 80 inches—light yellowish brown, stratified very gravelly coarse sand and coarse sand

Soil Properties and Qualities

Permeability: Mancelona—moderately rapid in the surface layer and subsoil and very rapid in the substratum; East Lake—rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Mancelona—moderate; East Lake—severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 45 to 65 percent
East Lake and similar soils: 25 to 45 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in landscape positions similar to or slightly lower than those of the Mancelona and East Lake soils
- The somewhat poorly drained Gladwin and Au Gres soils in depressions
- The very poorly drained Deford soils in depressions and drainageways

Similar inclusions:
- Areas where the subsoil is lighter in color
- Soils that have thin bands of loamy sand in the substratum

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone may improve the ability of the soils to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.
- Adjusting the rate of water application to the available water capacity, the water intake rate, and the needs of the crop can help to prevent overirrigating and excessive leaching of plant nutrients.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Mancelona—none; Rubicon—equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid or very rapid permeability

Management considerations:

- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: Mancelona—3s; East Lake—4s

Forestland ordination symbol: Mancelona—3A; East Lake—2S

Michigan soil management group: Mancelona—4a; East Lake—5a

337C—Mancelona-East Lake complex, 6 to 12 percent slopes

Setting

Landform: Low ridges and knolls on outwash plains, kame terraces, and stream terraces

Shape of areas: Irregular

Size of areas: 10 to 100 acres

Typical Profile

Mancelona

Surface layer:

0 to 2 inches—black loamy sand

Subsurface layer:

2 to 3 inches—pinkish gray loamy sand

Subsoil:

3 to 15 inches—brown loamy sand

15 to 25 inches—brown gravelly sand

25 to 31 inches—strong brown gravelly loamy sand

31 to 36 inches—dark brown very gravelly loamy sand

Substratum:

36 to 80 inches—stratified, light brown very gravelly sand and pink sand

East Lake

Surface layer:

0 to 1 inch—very dark brown sand

Subsurface layer:

1 to 4 inches—brown sand

Subsoil:

4 to 8 inches—brown sand

8 to 18 inches—strong brown sand

18 to 31 inches—yellowish brown and brownish yellow sand

Substratum:

31 to 35 inches—yellowish brown very gravelly loamy coarse sand

35 to 80 inches—light yellowish brown, stratified very gravelly coarse sand and coarse sand

Soil Properties and Qualities

Permeability: Mancelona—moderately rapid in the surface layer and subsoil and very rapid in the substratum; East Lake—rapid

Available water capacity: Low

Drainage class: Somewhat excessively drained

Seasonal high water table: At a depth of more than 6.5 feet

Surface runoff class: Very low

Flooding: None

Hazard of water erosion: Slight

Hazard of soil blowing: Mancelona—moderate; East Lake—severe

Shrink-swell potential: Low

Potential for frost action: Low

Composition

Mancelona and similar soils: 45 to 65 percent

East Lake and similar soils: 25 to 45 percent

Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:

- The moderately well drained Croswell soils in landscape positions similar to or slightly lower than those of the Mancelona and East Lake soils
- The somewhat poorly drained Gladwin and Au Gres soils in depressions
- The very poorly drained Deford soils in depressions and drainageways

Similar inclusions:

- Areas where the subsoil is lighter in color

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss

Management considerations:

- A system of conservation tillage that leaves crop residue on the surface is effective in conserving

moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone may improve the ability of the soils to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Mancelona—none; East Lake—equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings can reduce the seedling mortality rate.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid or very rapid permeability, slope
Management considerations:
- The poor filtering capacity of these soils can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: Mancelona—3e; East Lake—6s
Forestland ordination symbol: Mancelona—3A; East Lake—2S
Michigan soil management group: Mancelona—4a; East Lake—5a

338B—Islandlake sand, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on outwash plains
Shape of areas: Irregular
Size of areas: 5 to 2,000 acres

Typical Profile

Surface layer:
0 to 10 inches—very dark grayish brown sand

Subsurface layer:
10 to 13 inches—brown sand

Subsoil:
13 to 16 inches—dark brown sand
16 to 30 inches—strong brown and yellowish brown sand
30 to 80 inches—light yellowish brown sand with thin bands of strong brown sand and loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Islandlake and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in swales and along drainageways

Similar inclusions:
- Soils that have a surface layer of loamy sand

- Soils that do not have bands in the subsoil
- Soils that have a lighter colored subsoil

Use and Management

Land use: Dominant use—forestland (fig. 12); other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss

Management considerations:

- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.
- Adjusting the rate of water application to the available water capacity, the water intake rate, and the needs of the crop can help to prevent overirrigating and excessive leaching of plant nutrients.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness

Management considerations:

- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, seedling mortality

Figure 12.—Aspen regeneration following clear cutting on Islandlake sand, 0 to 6 percent slopes.

Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 4s
Forestland ordination symbol: 3S
Michigan soil management group: 5a

338C—Islandlake sand, 6 to 12 percent slopes

Setting

Landform: Low knolls and ridges on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 500 acres

Typical Profile

Surface layer:
0 to 10 inches—very dark grayish brown sand

Subsurface layer:
10 to 13 inches—brown sand

Subsoil:
13 to 16 inches—dark brown sand
16 to 30 inches—strong brown and yellowish brown sand
30 to 80 inches—light yellowish brown sand with thin bands of strong brown sand and loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Islandlake and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils along drainageways
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have a surface layer of loamy sand
- Soils that do not have bands in the subsoil
- Soils that have a lighter colored subsoil

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.

- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 3S
Michigan soil management group: 5a

338D—Islandlake sand, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 100 acres

Typical Profile

Surface layer:
0 to 10 inches—very dark grayish brown sand

Subsurface layer:
10 to 13 inches—brown sand

Subsoil:
13 to 16 inches—dark brown sand
16 to 30 inches—strong brown and yellowish brown sand
30 to 80 inches—light yellowish brown sand with thin bands of strong brown sand and loamy sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Islandlake and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils
- The somewhat poorly drained Au Gres soils in depressions

Similar inclusions:
- Soils that have a surface layer of loamy sand
- Soils that do not have bands in the subsoil
- Soils that have a lighter colored subsoil

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 3S
Michigan soil management group: 5a

347F—Kalkaska sand, 8 to 50 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 25 to 600 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed forest litter

Surface layer:
1 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 12 inches—dark reddish brown sand
12 to 41 inches—brown, strong brown, and yellowish brown sand

Substratum:
41 to 80 inches—light yellowish brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Kalkaska and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Feldhauser soils
- The moderately well drained Croswell soils

Similar inclusions:
- Soils that have thin bands of loamy sand in the subsoil or substratum
- Soils that have bands of gravelly sand in the substratum
- Soils that have a less well developed subsoil

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging

roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because of the slope, most areas of this soil are unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, rapid permeability
Management considerations:
- Because of the slope, most areas of this soil are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 3R
Michigan soil management group: 5a

349B—Hartwick sand, 0 to 6 percent slopes

Setting

Landform: Outwash channels
Shape of areas: Irregular
Size of areas: 10 to 300 acres

Typical Profile

Surface layer:
0 to 2 inches—black sand

Subsurface layer:
2 to 7 inches—brown sand

Subsoil:
7 to 12 inches—dark brown sand
12 to 26 inches—strong brown very gravelly sand
26 to 38 inches—yellowish brown gravelly sand

Substratum:
38 to 80 inches—light yellowish brown sand stratified with gravelly coarse sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Hartwick and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The well drained Blue Lake soils on uplands

Similar inclusions:
- Soils that have a loamy layer in the subsoil
- Soils that have a surface layer of loamy sand

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability

Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 4S
Michigan soil management group: 5a

350D—Blue Lake sand, 6 to 18 percent slopes

Setting

Landform: Knolls and low ridges on moraines and outwash plains
Shape of areas: Irregular
Size of areas: 5 to 400 acres

Typical Profile

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 15 inches—dark brown sand
15 to 25 inches—yellowish brown sand
25 to 80 inches—light yellowish brown sand that has bands of strong brown sandy loam

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Blue Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Rubicon soils, which have less clay in the subsoil than the Blue Lake soil and are in landscape positions similar to those of the Blue Lake soil
- The excessively drained Grayling soils, which are on the downslope edges of the unit and in landscape positions similar to those of the Blue Lake soil

Similar inclusions:
- Excessively drained soils in which bands of loamy sand in the subsoil have a total thickness of less than 6 inches
- Moderately well drained soils
- Soils with a surface layer of loamy sand

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, plant competition
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Planting when the soil is moist and planting seedlings that can withstand droughty conditions reduce the seedling mortality rate. Replanting is needed in some areas.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Carefully managed reforestation helps to control undesirable understory plants.

Pasture

Major management concerns: Droughtiness, soil blowing
Management considerations:
- Proper stocking rates and short-duration grazing during the summer help to control soil blowing, maintain plant density and hardiness, and keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 3S
Michigan soil management group: 4a

352B—Deford-Au Gres-Croswell complex, 0 to 6 percent slopes

Setting

Landform: Flats, shallow depressions, or low knolls adjacent to drainageways and swamps on outwash plains and stream terraces
Shape of areas: Irregular
Size of areas: 3 to 160 acres

Typical Profile

Deford

Surface layer:
0 to 5 inches—black muck

Subsurface layer:
5 to 9 inches—grayish brown, mottled sand

Subsoil:
9 to 29 inches—dark yellowish brown and dark brown, mottled sand

Substratum:
29 to 55 inches—grayish brown, mottled sand
55 to 60 inches—dark grayish brown, mottled sand

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 11 inches—dark brown, mottled sand
11 to 42 inches—dark yellowish brown and yellowish brown, mottled sand

Substratum:
42 to 80 inches—brown sand

Croswell

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—grayish brown sand

Subsoil:
9 to 17 inches—brown sand
17 to 27 inches—strong brown sand
27 to 40 inches—brownish yellow, mottled sand

Substratum:
40 to 80 inches—very pale brown sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Deford—very poorly drained; Au Gres—somewhat poorly drained; Croswell—moderately well drained
Seasonal high water table: Deford—apparent, 1.0 foot above to 1.0 foot below the surface at some time from August through June; Au Gres—apparent, 0.5 foot to 1.5 feet below the surface at some time from October through June; Croswell—apparent, 2.0 to 3.5 feet below the surface at some time from October through December and from March through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Deford—moderate; Au Gres and Croswell—severe
Shrink-swell potential: Low
Potential for frost action: Croswell—low; Deford and Au Gres—moderate

Composition

Deford and similar soils: 40 to 60 percent
Au Gres and similar soils: 20 to 40 percent
Croswell and similar soils: 20 to 30 percent
Contrasting inclusions: 0 to 20 percent

Inclusions

Contrasting inclusions:
- The very poorly drained Leafriver soils in depressions

- The excessively drained Grayling and Rubicon soils on low knolls or the higher flats

Similar inclusions:
- Areas near the Croswell soil where the seasonal high water table is at a depth of 3.5 to 5.0 feet
- Areas where the subsoil is lighter in color
- Areas where the subsoil is partially cemented

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- In areas of the Deford and Au Gres soils, skidders should not be used during wet periods, when ruts form easily.
- In areas of the Deford and Au Gres soils, year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Because loose sand in areas of the Croswell soil can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Landing sites generally can be used only during the driest time of the year.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Deford soil.
- Trees that can withstand seasonal wetness should be selected for planting on the Au Gres soil.
- Planting when the Croswell soil is moist and planting seedlings that can withstand droughty conditions can lower the seedling mortality rate. Replanting is needed in some areas.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Caving of cutbanks, seasonal wetness
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- In areas of the Au Gres and Croswell soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because of ponding, the Deford soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Au Gres and Croswell—seasonal wetness, rapid permeability; Deford—ponding
Management considerations:
- The poor filtering capacity of the Croswell soil can result in the pollution of ground water.
- On large lots in areas of the Croswell soil, an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in the Croswell soil.
- Because of the high water table, the Au Gres soil is generally unsuited to septic tank absorption fields.
- Because of ponding, the Deford soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Deford—5w; Au Gres—4w; Croswell—4s
Forestland ordination symbol: Deford—4W; Au Gres—6W; Croswell—5S
Michigan soil management group: Deford—4c; Au Gres—5b; Croswell—5a

354F—Mancelona-Blue Lake sands, 15 to 70 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on kames and moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 5 to 300 acres

Typical Profile

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—pinkish gray sand

Subsoil:
6 to 16 inches—dark brown sand

16 to 29 inches—yellowish brown and light yellowish brown sand
29 to 35 inches—reddish brown gravelly sandy loam

Substratum:
35 to 80 inches—yellowish brown very gravelly sand

Blue Lake

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—brown sand

Subsoil:
6 to 15 inches—dark brown sand
15 to 25 inches—yellowish brown sand
25 to 80 inches—light yellowish brown sand with bands of strong brown sandy loam

Soil Properties and Qualities

Permeability: Mancelona—moderately rapid in the surface layer and subsoil and very rapid in the substratum; Blue Lake—moderately rapid
Available water capacity: Low
Drainage class: Mancelona—somewhat excessively drained; Blue Lake—well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 70 to 85 percent
Blue Lake and similar soils: 15 to 25 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat poorly drained Gladwin and Au Gres soils in depressions
- The moderately well drained Croswell soils

Similar inclusions:
- Soils that have a surface layer of loamy sand

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, erosion hazard
Management considerations:
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- If trees are planted on the Blue Lake soil, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, most areas of these soils are unsuited to building site development.
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Slope, very rapid permeability
Management considerations:
- Because of the slope, most areas of these soils are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7e
Forestland ordination symbol: 3R
Michigan soil management group: 4a

360—Wakeley muck

Setting

Landform: Shallow depressions on lake plains
Shape of areas: Irregular
Size of areas: 3 to 120 acres

Typical Profile

Surface layer:
0 to 7 inches—black muck

Substratum:
7 to 12 inches—grayish brown, mottled sand
12 to 21 inches—brown, mottled sand
21 to 25 inches—reddish brown, mottled, stratified silty clay and loamy sand
25 to 64 inches—reddish brown, mottled silty clay
64 to 80 inches—brown, mottled silty clay loam

Soil Properties and Qualities

Permeability: Rapid in the upper sandy material and slow in the lower clayey material
Available water capacity: Moderate
Drainage class: Poorly drained
Seasonal high water table: Perched, 1.0 foot above to 1.0 foot below the surface at some time from September through May
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low in the upper sandy material and high in the lower clayey material
Potential for frost action: Moderate

Composition

Wakeley and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Kellogg soils in the higher landscape positions
- The very poorly drained Deford and poorly drained Angelica soils in landscape positions similar to those of the Wakeley soil

Similar inclusions:
- Areas where the substratum is sandy loam

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 5w
Forestland ordination symbol: 3W
Michigan soil management group: 4/1c

362D—Millersburg loamy sand, 6 to 18 percent slopes

Setting

Landform: Drumlins and moraines
Shape of areas: Linear or irregular
Size of areas: 5 to 120 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 5 inches—brown sand

Subsoil:
5 to 10 inches—strong brown loamy sand
10 to 18 inches—pale brown sand and reddish brown sandy loam
18 to 26 inches—reddish brown sandy loam surrounded by pinkish gray loamy sand
26 to 34 inches—yellowish red sandy loam
34 to 43 inches—light reddish brown sandy loam

Substratum:
43 to 80 inches—light yellowish brown loamy sand

Soil Properties and Qualities

Permeability: Moderate

Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Millersburg and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Graycalm soils, which have less clay in the subsoil and substratum than the Millersburg soil and are in landscape positions similar to those of the Millersburg soil
- The somewhat excessively drained Mancelona soils, which have gravel in the subsoil and substratum and are in landscape positions similar to those of the Millersburg soil

Similar inclusions:
- Soils that have less clay in the subsoil
- Soils with a redder subsoil

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Carefully managed reforestation helps to control undesirable understory plants.

Pasture

Major management concerns: Seasonal droughtiness, overgrazing
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 3A
Michigan soil management group: 3a

365F—Blue Lake loamy sand, 8 to 50 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 3 to 200 acres

Typical Profile

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low

Potential for frost action: Low

Composition

Blue Lake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The excessively drained Rubicon soils in landscape positions similar to those of the Blue Lake soil
- The moderately well drained Feldhauser soils
- The moderately well drained Croswell soils

Similar inclusions:
- Soils in which bands of loamy sand in the lower part of the subsoil have a total thickness of less than 6 inches
- Soils that have bands of sandy loam in the lower part of the subsoil
- Areas where the upper part of the subsoil is lighter in color

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, plant competition
Management considerations:
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, most areas of this soil are unsuited to building site development.
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, most areas of this soil are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7e
Forestland ordination symbol: 3R
Michigan soil management group: 4a

368A—Au Gres-Deford complex, 0 to 3 percent slopes

Setting

Landform: Low flats and shallow depressions on outwash plains; also, low ridges in swamps
Shape of areas: Irregular
Size of areas: 3 to 210 acres

Typical Profile

Au Gres

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 9 inches—brown sand

Subsoil:
9 to 11 inches—brown, mottled sand
11 to 42 inches—dark yellowish brown and yellowish brown, mottled sand

Substratum:
42 to 80 inches—brown sand

Deford

Surface layer:
0 to 5 inches—black muck

Subsurface layer:
5 to 9 inches—grayish brown, mottled sand

Subsoil:
9 to 29 inches—dark yellowish brown and dark brown, mottled sand

Substratum:
29 to 55 inches—grayish brown, mottled sand
55 to 60 inches—dark grayish brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid

Available water capacity: Low
Drainage class: Au Gres—somewhat poorly drained; Deford—very poorly drained
Seasonal high water table: Au Gres—apparent, 0.5 foot to 1.5 feet below the surface at some time from October through June; Deford—apparent, 1.0 foot above to 1.0 foot below the surface at some time from August through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Au Gres—severe; Deford—moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Au Gres and similar soils: 50 to 70 percent
Deford and similar soils: 30 to 50 percent
Contrasting inclusions: 0 to 10 percent

Inclusions

Contrasting inclusions:
- The excessively drained Rubicon soils in the higher landscape positions
- The very poorly drained Leafriver and Tawas soils in landscape positions similar to those of the Deford soil

Similar inclusions:
- Areas where the subsoil is lighter in color
- Areas where the soil is moderately well drained

Use and Management

Land use: Dominant use—forestland; other use—building site development

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Skidders should not be used during wet periods, when ruts form easily.
- Year-round logging roads require roadfill and gravel. Culverts are needed in areas of the Deford soil to maintain the natural drainage system.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on the Deford soil.
- Trees that can withstand seasonal wetness should be selected for planting on the Au Gres soil.
- Competing vegetation can be controlled by mechanical or chemical means.

Buildings

Major management concerns: Au Gres—seasonal wetness, caving of cutbanks; Deford—ponding
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because of ponding, the Deford soil is generally unsuited to building site development.
- In areas of the Au Gres soil, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Au Gres—seasonal wetness, rapid permeability; Deford—ponding
Management considerations:
- Because of ponding, the Deford soil is generally unsuited to septic tank absorption fields.
- Because of the high water table, the Au Gres soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Au Gres—4w; Deford—5w
Forestland ordination symbol: Au Gres—6W; Deford—4W
Michigan soil management group: Au Gres—5b; Deford—4c

369—Deford muck

Setting

Landform: Low flats and shallow depressions on outwash plains
Shape of areas: Irregular
Size of areas: 3 to 20 acres

Typical Profile

Surface layer:
0 to 5 inches—black muck

Subsurface layer:
5 to 9 inches—grayish brown, mottled sand

Subsoil:
9 to 29 inches—dark yellowish brown and dark brown, mottled sand

Substratum:
29 to 55 inches—grayish brown, mottled sand
55 to 60 inches—dark grayish brown, mottled sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Very poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface at some time from August through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Deford and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in the higher landscape positions
- The very poorly drained Leafriver and Tawas soils in landscape positions similar to those of the Deford soil

Similar inclusions:
- Areas where the subsoil is lighter in color
- Areas where the soil is somewhat poorly drained

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Skidders should not be used during wet periods, when ruts form easily.
- Year-round logging roads require roadfill and gravel. Culverts are needed to maintain the natural drainage system.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Because of wetness, seedling mortality, and plant competition, trees are generally not planted on this soil.
- Competing vegetation can be controlled by mechanical or chemical means.

Buildings

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 5w
Forestland ordination symbol: 4W
Michigan soil management group: 4c

380—Access denied

Shape of areas: Square or rectangular
Size of areas: 40 to 3,800 acres

Composition

Unknown

Use and Management

Management considerations:
- Access was denied; therefore, no interpretations are given for these areas. Onsite investigation is needed.

Interpretive Groups

Land capability classification: None assigned
Forestland ordination symbol: None assigned
Michigan soil management group: None assigned

387F—Mancelona-Rubicon sands, 15 to 70 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on outwash plains, kames, and moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 3 to 200 acres

Typical Profile

Mancelona

Surface layer:
0 to 3 inches—black sand

Subsurface layer:
3 to 6 inches—pinkish gray sand

Subsoil:
6 to 16 inches—dark brown sand
16 to 20 inches—yellowish brown sand
20 to 29 inches—light yellowish brown sand
29 to 35 inches—reddish brown gravelly sandy loam

Substratum:
35 to 80 inches—yellowish brown very gravelly sand

Rubicon

Surface layer:
0 to 4 inches—black sand

Subsurface layer:
4 to 9 inches—brown sand

Subsoil:
9 to 47 inches—dark brown, strong brown, and yellowish brown sand

Substratum:
47 to 80 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Mancelona—moderately rapid in the surface layer and subsoil and very rapid in the substratum; Rubicon—rapid
Available water capacity: Low
Drainage class: Mancelona—somewhat excessively drained; Rubicon—excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Mancelona and similar soils: 55 to 75 percent
Rubicon and similar soils: 25 to 55 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Graycalm and Kalkaska soils in landscape positions similar to those of the Mancelona and Rubicon soils

Similar inclusions:
- Areas where the subsoil is lighter in color
- Soils that have thin bands of loamy sand in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Planting when the soils are moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because of the slope, most areas of these soils are unsuited to building site development.

Septic tank absorption fields

Major management concerns: Slope, rapid permeability

Management considerations:
- Because of the slope, most areas of these soils are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: Mancelona—7e; Rubicon—7s
Forestland ordination symbol: Mancelona—3R; Rubicon—4R
Michigan soil management group: Mancelona—4a; Rubicon—5.3a

393B—Morganlake loamy sand, 0 to 6 percent slopes

Setting

Landform: Flats and depressions on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Organic mat:
0 to 1 inch —black, partially decomposed leaf litter

Surface layer:
1 to 3 inches—very dark gray loamy sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 19 inches—dark brown and brown loamy sand and sand
19 to 39 inches—brown sand surrounding brown loamy sand
39 to 49 inches—reddish brown, mottled sandy clay loam surrounded by light brown, mottled loamy sand
49 to 54 inches—brown, mottled sandy clay loam

Substratum:
54 to 80 inches—brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid in the sandy material and moderately slow in the underlying loamy material
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched, 1.5 to 3.5 feet below the surface at some time from September through November and from March through May
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Moderate
Potential for frost action: Low

Composition

Morganlake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona and Blue Lake soils in landscape positions similar to those of the Morganlake soil
- The moderately well drained Ossineke soils in landscape positions similar to those of the Morganlake soil
- The poorly drained Angelica soils in depressions

Similar inclusions:
- Soils with a surface layer of sand

Use and Management

Land use: Dominant use—cropland; other uses—pasture, forestland, and building site development

Cropland

Major management concern: Soil blowing
Management considerations:
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.

Pasture

Major management concern: Overgrazing
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management considerations:
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Wetness, caving of cutbanks
Management considerations:
- Wetness can be reduced by a drainage system around structures with basements and crawl spaces.

• Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Wetness, rapid permeability
Management considerations:
• Filling or mounding with suitable material helps to raise the absorption field above the water table.
• The poor filtering capacity of this soil can result in the pollution of ground water.
• On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 3s
Forestland ordination symbol: 6A
Michigan soil management group: 4/2a

393C—Morganlake loamy sand, 6 to 12 percent slopes

Setting

Landform: Low knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 3 inches—very dark gray loamy sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 19 inches—dark brown and brown loamy sand and sand
19 to 39 inches—brown sand surrounding brown loamy sand
39 to 49 inches—reddish brown, mottled sandy clay loam surrounded by light brown, mottled loamy sand
49 to 54 inches—brown, mottled sandy clay loam

Substratum:
54 to 80 inches—brown sandy clay loam

Soil Properties and Qualities

Permeability: Rapid in the sandy material and moderately slow in the underlying loamy material
Available water capacity: Moderate
Drainage class: Moderately well drained
Seasonal high water table: Perched, 1.5 to 3.5 feet below the surface at some time from September through November and from March through May
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Low
Shrink-swell potential: Moderate
Potential for frost action: Low

Composition

Morganlake and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
• The well drained Mancelona and Blue Lake soils in landscape positions similar to those of the Morganlake soil
• The moderately well drained Ossineke soils in landscape positions similar to those of the Morganlake soil
• The poorly drained Angelica soils in closed depressions

Similar inclusions:
• Soils with a surface layer of sand

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concern: Soil blowing
Management considerations:
• Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.

Pasture

Major management concern: Overgrazing
Management considerations:
• Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
• Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition

Management considerations:
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Wetness, caving of cutbanks, slope
Management considerations:
- Wetness can be reduced by a drainage system around structures with basements and crawl spaces.
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Wetness, rapid permeability, slope
Management considerations:
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: 6A
Michigan soil management group: 4/2a

399D—Menominee-Bamfield, sandy substratum-Blue Lake complex, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Menominee

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 8 inches—grayish brown loamy sand

Subsoil:
8 to 19 inches—dark brown and dark yellowish brown loamy sand
19 to 23 inches—light brownish gray loamy sand
23 to 27 inches—light brownish gray loamy sand surrounding reddish brown sandy clay loam
27 to 36 inches—reddish brown sandy clay loam

Substratum:
36 to 48 inches—reddish brown sandy clay loam
48 to 80 inches—light reddish brown sandy clay loam

Bamfield, sandy substratum

Surface layer:
0 to 5 inches—black fine sandy loam

Subsoil:
5 to 11 inches—brown sandy loam
11 to 20 inches—grayish brown sandy loam
20 to 23 inches—grayish brown sandy loam surrounding brown clay loam
23 to 51 inches—brown clay loam

Substratum:
51 to 64 inches—brown clay loam
64 to 80 inches—light yellowish brown, stratified sand and gravelly sand

Blue Lake

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Menominee—rapid in the sandy material and moderately slow in the underlying loamy material; Bamfield, sandy substratum—moderately slow in the loamy material and rapid in the sandy material; Blue Lake—moderately rapid
Available water capacity: Menominee and Bamfield, sandy substratum—moderate; Blue Lake—low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Menominee—low; Bamfield, sandy substratum—medium; Blue Lake—very low
Flooding: None
Hazard of water erosion: Menominee and Blue Lake—slight; Bamfield, sandy substratum—moderate
Hazard of soil blowing: Moderate

Shrink-swell potential: Menominee and Bamfield, sandy substratum—moderate; Blue Lake—low
Potential for frost action: Bamfield, sandy substratum—moderate; Menominee and Blue Lake—low

Composition

Menominee and similar soils: 40 to 50 percent
Bamfield, sandy substratum, and similar soils: 25 to 35 percent
Blue Lake and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona soils in landscape positions similar to those of the Menominee, Bamfield, and Blue Lake soils
- The moderately well drained Ossineke and Morganlake soils
- The poorly drained Angelica soils in depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of sand

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Bamfield, sandy substratum—equipment limitations, plant competition; Menominee and Blue Lake—plant competition
Management considerations:
- Because of low strength in the Bamfield soil, suitable surfacing material is needed on year-round logging roads and landings.
- Species preference can be managed by selective cutting.

Pasture

Major management concerns: Menominee, Bamfield, and Blue Lake—overgrazing; Blue Lake—seasonal droughtiness
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Bamfield, sandy substratum—shrink-swell potential, frost action, slope; Menominee and Blue Lake—caving of cutbanks, slope
Management considerations:
- Because the slope requires extensive land shaping, these soils are poorly suited to building site development.
- In areas of the Bamfield soil, properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action.
- Because cutbanks in areas of the Menominee and Blue Lake soils are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Bamfield, sandy substratum—moderately slow permeability, slope; Menominee—rapid permeability, slope; Blue Lake—slope
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability of the Bamfield soil.
- The poor filtering capacity of the Menominee soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: Menominee—6A; Bamfield, sandy substratum—3S; Blue Lake—3S
Michigan soil management group: Menominee—4/2a; Bamfield, sandy substratum—3/2a; Blue Lake—4a

400F—Menominee-Bamfield, sandy substratum-Blue Lake complex, 18 to 70 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Menominee

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 8 inches—grayish brown loamy sand

Subsoil:
8 to 19 inches—dark brown and dark yellowish brown loamy sand
19 to 23 inches—light brownish gray loamy sand
23 to 27 inches—light brownish gray loamy sand surrounding reddish brown sandy clay loam
27 to 36 inches—reddish brown sandy clay loam

Substratum:
36 to 48 inches—reddish brown sandy clay loam
48 to 80 inches—light reddish brown sandy clay loam

Bamfield, sandy substratum

Surface layer:
0 to 5 inches—black fine sandy loam

Subsoil:
5 to 11 inches—brown sandy loam
11 to 20 inches—grayish brown sandy loam
20 to 23 inches—grayish brown sandy loam surrounding brown clay loam
23 to 51 inches—brown clay loam

Substratum:
51 to 64 inches—brown clay loam
64 to 80 inches—light yellowish brown, stratified sand and gravelly sand

Blue Lake

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Menominee—rapid in the sandy material and moderately slow in the underlying loamy material; Bamfield, sandy substratum—moderately slow in the loamy material and rapid in the sandy material; Blue Lake—moderately rapid
Available water capacity: Menominee and Bamfield, sandy substratum—moderate; Blue Lake—low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Menominee—medium; Bamfield, sandy substratum—high; Blue Lake—low
Flooding: None
Hazard of water erosion: Menominee and Blue Lake—moderate; Bamfield, sandy substratum—severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Menominee and Bamfield, sandy substratum—moderate; Blue Lake—low
Potential for frost action: Bamfield, sandy substratum—moderate; Menominee and Blue Lake—low

Composition

Menominee and similar soils: 40 to 50 percent
Bamfield, sandy substratum, and similar soils: 25 to 35 percent
Blue Lake and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona soils in landscape positions similar to those of the Menominee, Bamfield, and Blue Lake soils
- The poorly drained Angelica soils in closed depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of loamy sand or sand

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, plant competition
Management considerations:
- Because of low strength in the Bamfield soil, suitable surfacing material is needed on year-round logging roads and landings.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on these slopes. As a result, special logging methods, such as yarding the logs with a cable, may be needed.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and

drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Species preference can be managed by selective cutting.

Buildings

Major management concern: Slope
Management considerations:
- Because of the slope, most areas of these soils are unsuited to building site development.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, most areas of these soils are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7e
Forestland ordination symbol: Menominee—6R; Bamfield, sandy substratum, and Blue Lake—3R
Michigan soil management group: Menominee—4/2a; Bamfield, sandy substratum—3/2a; Blue Lake—4a

401F—Lindquist sand, 8 to 50 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Surface layer:
0 to 1 inch—black sand

Subsurface layer:
1 to 3 inches—pinkish gray sand

Subsoil:
3 to 10 inches—dark brown sand
10 to 28 inches—strong brown and reddish yellow sand
28 to 79 inches—light brown sand with thin bands of brown sand and loamy sand

Substratum:
79 to 80 inches—pinkish gray sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Severe
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Lindquist and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mossback and Bamfield soils in landscape positions similar to those of the Lindquist soil
- The moderately well drained Croswell soils

Similar inclusions:
- Soils that have bands of gravelly sand in the subsoil
- Soils that have calcareous sand and gravel in the substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, seedling mortality
Management considerations:
- Because loose sand can interfere with the traction of wheeled equipment, logging roads should be stabilized.
- Because loose sand and the slope can hinder the traction of wheeled equipment, skid roads should be built on the contour or on the gentler slopes.
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the

trees are logged also help to prevent excessive soil loss.
- Planting when the soil is moist and planting special nursery stock or containerized seedlings reduce the seedling mortality rate.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 6R
Michigan soil management group: 5.3a

402B—Islandlake loamy sand, 0 to 6 percent slopes

Setting

Landform: Outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 1,000 acres

Typical Profile

Surface layer:
0 to 2 inches—very dark gray loamy sand

Subsurface layer:
2 to 7 inches—brown loamy sand

Subsoil:
7 to 12 inches—dark brown loamy sand
12 to 28 inches—brown and strong brown sand
28 to 60 inches—brown sand with thin bands of strong brown sand and loamy sand

Substratum:
60 to 80 inches—reddish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Islandlake and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils in depressions

Similar inclusions:
- Soils that have a surface layer of sand
- Soils in which bands in the subsoil have a total thickness of more than 6 inches
- Soils that do not have bands in the subsoil
- Soils that have a lighter colored subsoil

Use and Management

Land use: Dominant use—cropland; other uses—forestland, pasture, and building site development

Cropland

Major management concerns: Soil blowing, nutrient and pesticide loss, seasonal droughtiness (fig. 13), a low content of organic matter
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.
- Adjusting the rate of water application to the available water capacity, the water intake rate, and the needs of the crop can help to prevent overirrigating and excessive leaching of plant nutrients and pesticides.
- Drought-tolerant crops should be selected for planting, or the soil should be irrigated.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.

Figure 13.—Because of droughtiness, irrigation is needed if potatoes are grown on Islandlake loamy sand, 0 to 6 percent slopes.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Rapid permeability
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: 4s

Forestland ordination symbol: 3A
Michigan soil management group: 5a

402C—Islandlake loamy sand, 6 to 12 percent slopes

Setting

Landform: Low knolls and low ridges on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 1,000 acres

Typical Profile

Surface layer:
0 to 2 inches—very dark gray loamy sand

Subsurface layer:
2 to 7 inches—brown loamy sand

Subsoil:
7 to 12 inches—dark brown loamy sand
12 to 28 inches—brown and strong brown sand
28 to 60 inches—brown sand with thin bands of strong brown sand and loamy sand

Substratum:
60 to 80 inches—reddish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Islandlake and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils

Similar inclusions:
- Soils in which bands in the subsoil have a total thickness of more than 6 inches
- Soils that have a surface layer of sand
- Soils that do not have bands in the subsoil
- Soils that have a lighter colored subsoil

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Seasonal droughtiness, soil blowing, a low content of organic matter, nutrient and pesticide loss
Management considerations:
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and in reducing the hazard of soil blowing.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter.
- Increasing the content of organic matter in the root zone may improve the ability of the soil to hold water, nutrients, and pesticides and thus reduce the risk of ground-water pollution.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope

Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 6s
Forestland ordination symbol: 3A
Michigan soil management group: 5a

402D—Islandlake loamy sand, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on outwash plains and moraines
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 2 inches—very dark gray loamy sand

Subsurface layer:
2 to 7 inches—brown loamy sand

Subsoil:
7 to 12 inches—dark brown loamy sand
12 to 28 inches—brown and strong brown sand
28 to 60 inches—brown sand with thin bands of strong brown sand and loamy sand

Substratum:
60 to 80 inches—reddish yellow sand

Soil Properties and Qualities

Permeability: Rapid
Available water capacity: Low
Drainage class: Somewhat excessively drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Islandlake and similar soils: 95 to 100 percent
Contrasting inclusions: 0 to 5 percent

Inclusions

Contrasting inclusions:
- The moderately well drained Croswell soils

Similar inclusions:
- Soils in which bands in the subsoil have a total thickness of more than 6 inches
- Soils that have a surface layer of sand
- Soils that do not have bands in the subsoil
- Soils that have a lighter colored subsoil

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concern: Plant competition
Management considerations:
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.

Pasture

Major management concerns: Overgrazing, seasonal droughtiness
Management considerations:
- Proper stocking rates, controlled grazing, and restricted use during dry periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.

Septic tank absorption fields

Major management concerns: Rapid permeability, slope
Management considerations:
- The poor filtering capacity of this soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 7s
Forestland ordination symbol: 3A
Michigan soil management group: 5a

424B—Morganlake-Ossineke, sandy substratum-Blue Lake complex, 0 to 6 percent slopes

Setting

Landform: Flats on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Morganlake

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 3 inches—very dark gray loamy sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 19 inches—dark brown and brown loamy sand and sand
19 to 39 inches—brown sand surrounding brown loamy sand
39 to 49 inches—reddish brown, mottled sandy clay loam surrounded by light brown, mottled loamy sand
49 to 54 inches—brown, mottled sandy clay loam

Substratum:
54 to 80 inches—brown sandy clay loam

Ossineke, sandy substratum

Surface layer:
0 to 8 inches—very dark grayish brown fine sandy loam

Subsoil:
8 to 13 inches—brown sandy loam
13 to 21 inches—dark reddish brown sandy clay loam surrounded by brown sandy loam
21 to 38 inches—dark reddish brown, mottled sandy clay loam
38 to 51 inches—brown, mottled sandy loam

Substratum:
51 to 77 inches—brown, mottled sandy loam
77 to 80 inches—yellowish brown sand

Blue Lake

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Morganlake—rapid in the sandy material and moderately slow in the underlying loamy material; Ossineke, sandy substratum—moderately slow in the loamy material and rapid in the sandy material; Blue Lake—moderately rapid
Available water capacity: Morganlake—moderate; Ossineke, sandy substratum—high; Blue Lake—low
Drainage class: Morganlake and Ossineke, sandy substratum—moderately well drained; Blue Lake—well drained
Seasonal high water table: Morganlake—perched, 1.5 to 3.5 feet below the surface at some time from September through November and from March through May; Ossineke, sandy substratum—perched, 1.5 to 3.5 feet below the surface at some time in October and November and from March through May; Blue Lake—at a depth of more than 6.5 feet
Surface runoff class: Morganlake and Blue Lake—negligible; Ossineke, sandy substratum—low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Ossineke, sandy substratum—moderate; Morganlake and Blue Lake—low
Potential for frost action: Ossineke, sandy substratum—moderate; Morganlake and Blue Lake—low

Composition

Morganlake and similar soils: 40 to 50 percent
Ossineke, sandy substratum, and similar soils: 25 to 35 percent
Blue Lake and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona, Bamfield, and Menominee soils in the steeper areas
- The poorly drained Angelica soils in depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of loamy sand or sand

Use and Management

Land use: Dominant use—cropland; other uses—pasture, forestland, and building site development

Cropland

Major management concerns: Ossineke, sandy substratum—water erosion; Morganlake and Blue Lake—soil blowing; Blue Lake—seasonal droughtiness, a low content of organic matter
Management considerations:
- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion on the Ossineke soil.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing on the Morganlake and Blue Lake soils.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and reducing the hazard of soil blowing in areas of the Blue Lake soil.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter in the Blue Lake soil.

Pasture

Major management concerns: Morganlake, Ossineke, and Blue Lake—overgrazing; Blue Lake—seasonal droughtiness
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Ossineke, sandy substratum—equipment limitations, plant competition; Morganlake and Blue Lake—plant competition
Management considerations:
- Because of low strength in the Ossineke soil, suitable surfacing material is needed on year-round logging roads and landings.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Ossineke, sandy substratum—shrink-swell potential, frost action, wetness; Morganlake—wetness; Morganlake and Blue Lake—caving of cutbanks
Management considerations:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action in the Ossineke soil.
- In areas of the Ossineke and Morganlake soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because cutbanks in areas of the Morganlake and Blue Lake soils are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Ossineke, sandy substratum—moderately slow permeability, wetness; Morganlake—wetness, rapid permeability; Blue Lake—none
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability of the Ossineke soil.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in the Ossineke and Morganlake soils.
- The poor filtering capacity of the Morganlake soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.

Interpretive Groups

Land capability classification: Ossineke, sandy substratum—3e; Morganlake and Blue Lake—3s
Forestland ordination symbol: Morganlake—6A; Blue Lake—3A; Ossineke, sandy substratum—4L
Michigan soil management group: Morganlake—4/2a; Ossineke, sandy substratum—3a; Blue Lake—4a

424C—Morganlake-Ossineke, sandy substratum-Blue Lake complex, 6 to 12 percent slopes

Setting

Landform: Low knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Morganlake

Organic mat:
0 to 1 inch—black, partially decomposed leaf litter

Surface layer:
1 to 3 inches—very dark gray loamy sand

Subsurface layer:
3 to 10 inches—pinkish gray sand

Subsoil:
10 to 19 inches—dark brown and brown loamy sand and sand
19 to 39 inches—brown sand surrounding brown loamy sand
39 to 49 inches—reddish brown, mottled sandy clay loam surrounded by light brown, mottled loamy sand
49 to 54 inches—brown, mottled sandy clay loam

Substratum:
54 to 80 inches—brown sandy clay loam

Ossineke, sandy substratum

Surface layer:
0 to 8 inches—very dark grayish brown fine sandy loam

Subsoil:
8 to 13 inches—brown sandy loam
13 to 21 inches—dark reddish brown sandy clay loam surrounded by brown sandy loam
21 to 38 inches—dark reddish brown, mottled sandy clay loam
38 to 51 inches—brown, mottled sandy loam

Substratum:
51 to 77 inches—brown, mottled sandy loam
77 to 80 inches—yellowish brown sand

Blue Lake

Surface layer:
0 to 3 inches—black loamy sand

Subsurface layer:
3 to 7 inches—grayish brown sand

Subsoil:
7 to 26 inches—dark reddish brown and brown sand
26 to 80 inches—yellowish brown sand with bands of brown loamy sand

Soil Properties and Qualities

Permeability: Morganlake—rapid in the sandy material and moderately slow in the underlying loamy material; Ossineke, sandy substratum—moderately slow in the loamy material and rapid in the sandy material; Blue Lake—moderately rapid
Available water capacity: Morganlake—moderate; Ossineke, sandy substratum—high; Blue Lake—low
Drainage class: Morganlake and Ossineke, sandy substratum—moderately well drained; Blue Lake—well drained
Seasonal high water table: Morganlake—perched, 1.5 to 3.5 feet below the surface at some time from September through November and from March through May; Ossineke, sandy substratum—perched, 1.5 to 3.5 feet below the surface at some time in October and November and from March through May; Blue Lake—at a depth of more than 6.5 feet
Surface runoff class: Morganlake and Blue Lake—very low; Ossineke, sandy substratum—medium
Flooding: None
Hazard of water erosion: Morganlake and Blue Lake—slight; Ossineke, sandy substratum—moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Ossineke, sandy substratum—moderate; Morganlake and Blue Lake—low
Potential for frost action: Ossineke, sandy substratum—moderate; Morganlake and Blue Lake—low

Composition

Morganlake and similar soils: 40 to 50 percent
Ossineke, sandy substratum, and similar soils: 25 to 35 percent
Blue Lake and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona soils in landscape positions similar to those of the Morganlake, Ossineke, and Blue Lake soils
- The well drained Bamfield, sandy substratum, and Menominee soils on backslopes
- The poorly drained Angelica soils in depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils that have a surface layer of loamy sand or sand

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Ossineke, sandy substratum—water erosion; Morganlake and Blue Lake—soil blowing; Blue Lake—available water capacity, content of organic matter
Management considerations:
- Inclusion of close-growing crops in the cropping sequence, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss on the Ossineke soil.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing on the Morganlake and Blue Lake soils.
- A system of conservation tillage that leaves crop residue on the surface is effective in conserving moisture and reducing the hazard of soil blowing in areas of the Blue Lake soil.
- Inclusion of green manure crops in the cropping sequence, conservation tillage, and crop residue management increase the content of organic matter in the Blue Lake soil.

Pasture

Major management concerns: Morganlake, Ossineke, and Blue Lake—overgrazing; Blue Lake—seasonal droughtiness
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Ossineke, sandy substratum—equipment limitations, plant competition; Morganlake and Blue Lake—plant competition
Management considerations:
- Because of low strength in the Ossineke soil, suitable surfacing material is needed on year-round logging roads and landings.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Ossineke, sandy substratum—shrink-swell potential, frost action, wetness, slope; Morganlake—wetness; Morganlake and Blue Lake—caving of cutbanks, slope
Management considerations:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action in the Ossineke soil.
- In areas of the Ossineke and Morganlake soils, buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.
- Because cutbanks in areas of the Morganlake and Blue Lake soils are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Ossineke, sandy substratum—moderately slow permeability, wetness, slope; Morganlake—wetness, rapid permeability, slope; Blue Lake—slope
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability of the Ossineke soil.
- Filling or mounding with suitable material helps to raise the absorption field above the water table in the Ossineke and Morganlake soils.
- The poor filtering capacity of the Morganlake soil can result in the pollution of ground water.
- On large lots an absorption system with shallow trenches, shrubbery planted around the perimeter of the system, and low, uniform application rates minimizes the risk of ground-water pollution.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: Morganlake—6A; Blue Lake—3A; Ossineke, sandy substratum—4L

Michigan soil management group: Morganlake—4/2a; Ossineke, sandy substratum—3a; Blue Lake—4a

452D—Bamfield fine sandy loam, sandy substratum, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Surface layer:
0 to 5 inches—black fine sandy loam

Subsoil:
5 to 11 inches—brown sandy loam
11 to 20 inches—grayish brown sandy loam
20 to 23 inches—grayish brown sandy loam surrounding brown clay loam
23 to 51 inches—brown clay loam

Substratum:
51 to 64 inches—brown clay loam
64 to 80 inches—light yellowish brown, stratified sand and gravelly sand

Soil Properties and Qualities

Permeability: Moderately slow in the loamy material and rapid in the sandy material
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Moderate
Potential for frost action: Moderate

Composition

Bamfield and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Blue Lake, Mancelona, and Menominee soils in landscape positions similar to those of the Bamfield soil
- The moderately well drained Ossineke and Morganlake soils
- The poorly drained Angelica soils in depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of loamy sand or sand

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitations, plant competition
Management considerations:
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Species preference can be managed by selective cutting.

Pasture

Major management concern: Overgrazing
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Shrink-swell potential, frost action, slope
Management considerations:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action.
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.

Septic tank absorption fields

Major management concerns: Moderately slow permeability, slope
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 3L
Michigan soil management group: 3/2a

452E—Bamfield fine sandy loam, sandy substratum, 18 to 35 percent slopes

Setting

Landform: Hills, ridges, and escarpments on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Surface layer:
0 to 5 inches—black fine sandy loam

Subsoil:
5 to 11 inches—brown sandy loam
11 to 20 inches—grayish brown sandy loam
20 to 23 inches—grayish brown sandy loam surrounding brown clay loam
23 to 51 inches—brown clay loam

Substratum:
51 to 64 inches—brown clay loam
64 to 80 inches—light yellowish brown, stratified sand and gravelly sand

Soil Properties and Qualities

Permeability: Moderately slow in the loamy material and rapid in the sandy material
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: High
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Moderate
Potential for frost action: Moderate

Composition

Bamfield and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Blue Lake, Mancelona, and Menominee soils in landscape positions similar to those of the Bamfield soil
- The poorly drained Angelica soils in depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of loamy sand or sand

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Erosion hazard, equipment limitations, plant competition
Management considerations:
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Because of the slope, special care is needed in laying out the logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- Species preference can be managed by selective cutting.

Buildings

Major management concern: Slope
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6e
Forestland ordination symbol: 3R
Michigan soil management group: 3/2a

453B—Ossineke fine sandy loam, sandy substratum, 0 to 6 percent slopes

Setting

Landform: Flats and depressions on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark grayish brown fine sandy loam

Subsoil:
8 to 13 inches—brown sandy loam
13 to 21 inches—dark reddish brown sandy clay loam surrounded by brown sandy loam
21 to 38 inches—dark reddish brown, mottled sandy clay loam
38 to 51 inches—brown, mottled sandy loam

Substratum:
51 to 77 inches—brown, mottled sandy loam
77 to 80 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Moderately slow in the loamy material and rapid in the sandy material
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: Perched, 1.5 to 3.5 feet below the surface at some time in October and November and from March through May
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Moderate
Potential for frost action: Moderate

Composition

Ossineke and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona, Bamfield, and Menominee soils in the steeper areas
- The poorly drained Angelica soils in closed depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of loamy sand or sand

Use and Management

Land use: Dominant uses—cropland (fig. 14); other uses—pasture, forestland, and building site development

Cropland

Major management concerns: Water erosion, tilth of the surface layer
Management considerations:
- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concerns: Overgrazing, compaction
Management considerations:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, plant competition
Management considerations:
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Shrink-swell potential, frost action, wetness
Management considerations:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action.
- Buildings can be constructed on well compacted fill material, which raises the site a sufficient distance above the water table.

Septic tank absorption fields

Major management concerns: Moderately slow permeability, wetness
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: 4L
Michigan soil management group: 3a

Figure 14.—Hay on Ossineke fine sandy loam, sandy substratum, 0 to 6 percent slopes.

453C—Ossineke fine sandy loam, sandy substratum, 6 to 12 percent slopes

Setting

Landform: Low knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 10 to 500 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark grayish brown fine sandy loam

Subsoil:
8 to 13 inches—brown sandy loam
13 to 21 inches—dark reddish brown sandy clay loam surrounded by brown sandy loam
21 to 38 inches—dark reddish brown, mottled sandy clay loam
38 to 51 inches—brown, mottled sandy loam

Substratum:
51 to 77 inches—brown, mottled sandy loam
77 to 80 inches—yellowish brown sand

Soil Properties and Qualities

Permeability: Moderately slow in the loamy material and rapid in the sandy material
Available water capacity: High
Drainage class: Moderately well drained
Seasonal high water table: Perched, 1.5 to 3.5 feet below the surface at some time in October and November and from March through May
Surface runoff class: Medium
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Moderate
Potential for frost action: Moderate

Composition

Ossineke and similar soils: 85 to 95 percent
Contrasting inclusions: 5 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mancelona soils in landscape positions similar to those of the Ossineke soil

- The well drained Bamfield and Menominee soils on backslopes
- The poorly drained Angelica soils in closed depressions
- The very poorly drained Cathro soils in depressions

Similar inclusions:
- Soils with a surface layer of loamy sand or sand

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Water erosion, tilth of the surface layer
Management considerations:
- Inclusion of close-growing crops in the cropping sequence, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Minimizing tillage and tilling and harvesting at the proper soil moisture content help to prevent excessive compaction and maintain tilth.

Pasture

Major management concerns: Overgrazing, compaction
Management considerations:
- Proper stocking rates, a planned grazing system, and deferred grazing during wet periods help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, plant competition
Management considerations:
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- Species preference can be managed by selective cutting.

Buildings

Major management concerns: Shrink-swell potential, frost action, wetness, slope
Management considerations:
- Properly designing and strengthening footings and foundations can help to prevent the structural damage caused by shrinking and swelling and by frost action.
- Wetness can be reduced by a drainage system around structures with basements and crawl spaces.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderately slow permeability, wetness, slope
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Filling or mounding with suitable material helps to raise the absorption field above the water table.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: 4L
Michigan soil management group: 3a

463F—Leelanau loamy sand, 8 to 50 percent slopes, dissected

Setting

Landform: Hills, ridges, and escarpments on moraines
Distinctive landscape feature: A dissected landscape
Shape of areas: Irregular
Size of areas: 3 to 260 acres

Typical Profile

Surface layer:
0 to 2 inches—black loamy sand

Subsurface layer:
2 to 7 inches—light brownish gray sand

Subsoil:
7 to 21 inches—dark brown, brown, and dark yellowish brown sand
21 to 37 inches—yellowish brown sand surrounding brown sandy loam
37 to 52 inches—brown sandy loam

Substratum:
52 to 80 inches—brown loamy sand

Soil Properties and Qualities

Permeability: Moderately rapid
Available water capacity: Low
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None

Hazard of water erosion: Moderate or severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Low

Composition

Leelanau and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mossback soils in landscape positions similar to those of the Leelanau soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil
- Soils that have a sandy substratum

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, erosion hazard, plant competition
Management considerations:
- Ordinary crawler tractors and rubber-tired skidders cannot be operated safely on the very steep side slopes of the ravines.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Because of the slope, most areas of this soil are unsuited to building site development.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, most areas of this soil are unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 7e
Forestland ordination symbol: 6R
Michigan soil management group: 4a

464B—Mossback sandy loam, 0 to 6 percent slopes

Setting

Landform: Flats and low knolls on end moraines
Shape of areas: Irregular
Size of areas: 3 to 460 acres

Typical Profile

Surface layer:
0 to 3 inches—black sandy loam

Subsoil:
3 to 11 inches—dark yellowish brown sandy loam
11 to 13 inches—pale brown loamy sand
13 to 18 inches—grayish brown loamy sand surrounding reddish brown sandy loam
18 to 24 inches—reddish brown sandy clay loam
24 to 44 inches—dark brown sandy loam

Substratum:
44 to 74 inches—brown sandy loam
74 to 80 inches—yellowish brown sand and gravelly loamy sand

Soil Properties and Qualities

Permeability: Moderate in the loamy material and rapid in the sandy material
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Very low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate

Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Mossback and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Kalkaska and well drained Blue Lake and Leelanau soils in landscape positions similar to those of the Mossback soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil

Use and Management

Land use: Dominant use—cropland; other uses—forestland, pasture, and building site development

Cropland

Major management concerns: Water erosion, soil blowing
Management considerations:
- Crop rotations that include grasses, legumes, and small grain help to control runoff and water erosion.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.

Pasture

Major management concern: Overgrazing
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, plant competition
Management considerations:
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concern: Caving of cutbanks
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Moderate permeability
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

Interpretive Groups

Land capability classification: 2e
Forestland ordination symbol: 3L
Michigan soil management group: 3a

464C—Mossback sandy loam, 6 to 12 percent slopes

Setting

Landform: Knolls and low ridges on moraines
Shape of areas: Irregular
Size of areas: 3 to 260 acres

Typical Profile

Surface layer:
0 to 3 inches—black sandy loam

Subsoil:
3 to 11 inches—dark yellowish brown sandy loam
11 to 13 inches—pale brown loamy sand
13 to 18 inches—grayish brown loamy sand surrounding reddish brown sandy loam
18 to 24 inches—reddish brown sandy clay loam
24 to 44 inches—dark brown sandy loam

Substratum:
44 to 74 inches—brown sandy loam
74 to 80 inches—yellowish brown sand and gravelly loamy sand

Soil Properties and Qualities

Permeability: Moderate in the loamy material and rapid in the sandy material
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low

Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Mossback and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Kalkaska and well drained Blue Lake and Leelanau soils in landscape positions similar to those of the Mossback soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil

Use and Management

Land use: Dominant use—forestland; other uses—cropland, pasture, and building site development

Cropland

Major management concerns: Water erosion, soil blowing
Management considerations:
- Inclusion of close-growing crops in the cropping sequence, conservation tillage, grassed waterways, cover crops, and crop residue management help to prevent excessive soil loss.
- Conservation tillage, crop residue management, windbreaks, and cover crops help to control soil blowing.

Pasture

Major management concern: Overgrazing
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Forestland

Major management concerns: Equipment limitations, plant competition
Management considerations:
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.
- Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas.

Septic tank absorption fields

Major management concerns: Moderate permeability, slope
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 3e
Forestland ordination symbol: 3L
Michigan soil management group: 3a

464D—Mossback sandy loam, 12 to 18 percent slopes

Setting

Landform: Knolls and ridges on moraines
Shape of areas: Irregular
Size of areas: 3 to 260 acres

Typical Profile

Surface layer:
0 to 3 inches—black sandy loam

Subsoil:
3 to 11 inches—dark yellowish brown sandy loam
11 to 13 inches—pale brown loamy sand
13 to 18 inches—grayish brown loamy sand surrounding reddish brown sandy loam
18 to 24 inches—reddish brown sandy clay loam
24 to 44 inches—dark brown sandy loam

Substratum:
44 to 74 inches—brown sandy loam
74 to 80 inches—yellowish brown sand and gravelly loamy sand

Soil Properties and Qualities

Permeability: Moderate in the loamy material and rapid in the sandy material
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Low
Flooding: None
Hazard of water erosion: Moderate
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Mossback and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Kalkaska and Mancelona and well drained Blue Lake and Leelanau soils in landscape positions similar to those of the Mossback soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil

Use and Management

Land use: Dominant use—forestland; other uses—pasture and building site development

Forestland

Major management concerns: Equipment limitation, plant competition
Management considerations:
- Because of low strength, suitable surfacing material is needed on year-round logging roads and landings.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Pasture

Major management concern: Overgrazing
Management considerations:
- Proper stocking rates, a uniform distribution of grazing, and a planned grazing system help to keep the pasture in good condition.
- Applying lime and fertilizer according to the results of soil tests helps to ensure the maximum growth of plants, especially legumes.

Buildings

Major management concerns: Caving of cutbanks, slope
Management considerations:
- Because the slope requires extensive land shaping, this soil is poorly suited to building site development.
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concerns: Moderate permeability, slope
Management considerations:
- Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.
- Land shaping and installing the distribution lines on the contour help to overcome the slope.

Interpretive Groups

Land capability classification: 4e
Forestland ordination symbol: 3L
Michigan soil management group: 3a

464E—Mossback sandy loam, 18 to 35 percent slopes

Setting

Landform: Hills, ridges, and escarpments on moraines
Shape of areas: Irregular
Size of areas: 3 to 260 acres

Typical Profile

Surface layer:
0 to 3 inches—black sandy loam

Subsoil:
3 to 11 inches—dark yellowish brown sandy loam
11 to 13 inches—pale brown loamy sand
13 to 18 inches—grayish brown loamy sand surrounding reddish brown sandy loam

18 to 24 inches—reddish brown sandy clay loam
24 to 44 inches—dark brown sandy loam

Substratum:
44 to 74 inches—brown sandy loam
74 to 80 inches—yellowish brown sand and gravelly loamy sand

Soil Properties and Qualities

Permeability: Moderate in the loamy material and rapid in the sandy material
Available water capacity: Moderate
Drainage class: Well drained
Seasonal high water table: At a depth of more than 6.5 feet
Surface runoff class: Medium
Flooding: None
Hazard of water erosion: Severe
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Mossback and similar soils: 85 to 100 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Kalkaska and Mancelona and well drained Blue Lake and Leelanau soils in landscape positions similar to those of the Mossback soil

Similar inclusions:
- Soils that have a surface layer of loamy fine sand
- Soils that have 15 to 20 percent gravel in part of the subsoil

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, erosion hazard, plant competition
Management considerations:
- Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.
- Small areas of nearly level included soils, if any are available, and suitable nearly level adjacent areas should be selected as sites for landings.
- Because of the erosion hazard, water should be removed from logging roads by water bars, out-sloping or in-sloping road surfaces, culverts, and drop structures. Building logging roads on the contour or on the gentler slopes and seeding logging roads, skid roads, and landings after the trees are logged also help to prevent excessive soil loss.
- The use of mechanical planters is limited by the slope. Hand planting of seedlings may be desirable.
- If trees are planted, site preparation by mechanical or chemical means is needed to control competing vegetation. Subsequent control of the invasion and growth of hardwoods may be needed.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concerns: Slope, caving of cutbanks
Management considerations:
- Because of the slope, this soil is generally unsuited to building site development.
- Because cutbanks are unstable and subject to caving, trench walls should be reinforced.

Septic tank absorption fields

Major management concern: Slope
Management considerations:
- Because of the slope, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 6e
Forestland ordination symbol: 3R
Michigan soil management group: 3a

465—Caffey muck

Setting

Landform: Depressions and side hill seeps on moraines
Shape of areas: Irregular
Size of areas: 3 to 120 acres

Typical Profile

Surface layer:
0 to 6 inches—black muck

Subsoil:
6 to 10 inches—pale brown, mottled sand
10 to 18 inches—yellowish brown, mottled loamy sand

Substratum:
18 to 29 inches—grayish brown and brown, mottled, stratified loam, very fine sandy loam, and sandy loam
29 to 41 inches—reddish brown, mottled, stratified silt loam and very fine sandy loam
41 to 58 inches—reddish brown, mottled, stratified sandy loam and loamy sand
58 to 80 inches—stratified, reddish brown, mottled silt and light olive brown, mottled very fine sandy loam

Soil Properties and Qualities

Permeability: Rapid or moderately rapid in the upper sandy material and moderately slow in the lower part of the profile
Available water capacity: Moderate
Drainage class: Poorly drained
Seasonal high water table: Apparent, 1.0 foot above to 1.0 foot below the surface at some time from September through June
Surface runoff class: Negligible
Flooding: None
Hazard of water erosion: Slight
Hazard of soil blowing: Moderate
Shrink-swell potential: Low
Potential for frost action: Moderate

Composition

Caffey and similar soils: 85 to 95 percent
Contrasting inclusions: 0 to 15 percent

Inclusions

Contrasting inclusions:
- The well drained Mossback and Blue Lake soils on uplands
- The poorly drained Wakeley soils in landscape positions similar to those of the Caffey soil

Similar inclusions:
- Soils that do not have a surface layer of muck
- Soils with more than 9 and less than 16 inches of muck

Use and Management

Dominant use: Forestland

Forestland

Major management concerns: Equipment limitations, seedling mortality, windthrow hazard, plant competition
Management considerations:
- Because of wetness and low strength, special harvesting equipment is needed. The equipment can be used only during periods in winter when skid roads and access roads are frozen.
- Landing sites generally can be used only during the driest time of the year.
- Windthrow can be minimized by harvest methods that do not leave the remaining trees widely spaced and by such harvest methods as selective cutting and strip cutting.
- Special harvest methods may be needed to control undesirable plants.
- Selective cutting or cutting in strips and naturally regenerating the area by leaving desirable seed trees along the edge of the openings can improve the stand.

Buildings

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to building site development.

Septic tank absorption fields

Major management concern: Ponding
Management considerations:
- Because of ponding, this soil is generally unsuited to septic tank absorption fields.

Interpretive Groups

Land capability classification: 5w
Forestland ordination symbol: 2W
Michigan soil management group: 4/2c

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as forestland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed for each soil, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading “Detailed Soil Map Units.” Specific information can be obtained from the local office of the Natural Resources Conservation Service or Michigan State University Extension.

In 1992, approximately 29,040 acres in Otsego County was used for crops or pasture. In 1995, about 1,200 acres was used for corn. Of this total, about 700 acres was harvested for silage. About 700 acres was used for potatoes, 400 acres for dry beans, 700 acres for oats, 9,000 acres for hay, and 10,890 acres for pasture (Michigan Department of Agriculture, 1996). A number of specialty crops also were grown. The most common of these were sunflowers, canola, pumpkins, and sweet corn.

Corn for silage, wheat, oats, and potatoes are the most commonly grown crops that are suited to the soils and climate of this survey area. Some others are canola, dry beans, and sunflowers. They can be grown if economic conditions are favorable. Alfalfa and mixtures of alfalfa and grasses are the most common hay crops.

Food production in Otsego County could be increased by applying soil and water conservation practices and by extending the latest crop production technology to the soils best suited to crops. The major management concerns in the areas used for crops and pasture are water erosion, wind erosion, droughtiness, wetness, fertility, and compaction.

Water erosion is a major hazard on about 6 percent of the cropland in Otsego County. The erodibility of the soil is dependent upon the gradient and length of slopes and the texture of the surface layer. If slopes are more than about 2 percent, water erosion is a hazard, especially in areas where the slopes are more than 400 feet long. Soils with a loamy or clayey surface layer are more susceptible to water erosion than sandy soils. In Otsego County the soils most susceptible to water erosion are Bamfield fine sandy loam, Feldhauser fine sandy loam, Kent sandy loam, Mossback sandy loam, and Ossineke fine sandy loam.

Loss of the surface layer through erosion reduces the productivity of the soils and results in sedimentation in lakes and streams. As the topsoil is eroded, organic matter is lost and clay in the subsoil is incorporated into the plow layer. As a result, the seedbed becomes poorer, the plants become stunted, the seedling mortality rate increases, and the soil becomes less resistant to further erosion. Also, water quality is reduced as the fertilizer and agricultural chemicals attached to the soil particles are deposited in surface waters.

Erosion-control practices reduce the slope length, provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. Keeping a plant or residue cover on the surface for extended periods helps to protect the surface from the impact of raindrops. Forage crops of grasses and legumes in the cropping sequence provide the best cover. They also provide nitrogen for the subsequent crops, ameliorate the effects of compaction, and improve tilth. Diversions, terraces, water- and sediment-control basins, contour farming, and contour stripcropping help to control water erosion by reducing slope length. Conservation tillage helps to control surface runoff and sheet erosion. The types of conservation tillage used in Otsego County include chisel-disk, plow-plant, and strip-till. Grassed waterways help to control gully erosion.

Wind erosion is a hazard on soils with a surface layer that has weak aggregate stability, such as the sandy Islandlake, Kalkaska, and Lindquist soils, and on soils with a surface layer of loamy sand or sandy loam, such as Blue Lake, Islandlake, Leelanau, Mancelona, Morganlake, and Mossback soils. Some of the loamy soils also are susceptible to wind erosion if they are not well managed. An adequate plant cover or surface mulch helps to control wind erosion by reducing wind velocity at the soil surface. Wind erosion also can be controlled by properly designed buffer strips and windbreaks planted at right angles to the prevailing winds.

Soil wetness is a major concern in about 1 percent of the cropland in the county. Drainage of cropland improves soil temperature and the air-water relationship in the root zone. In areas where drainage is restricted, spring planting, spraying, and harvesting are delayed and weed control is difficult. Properly designed tile drains, surface drains, or both can remove excess water.

Some soils are naturally so wet that they cannot be used for the crops commonly grown in the county. Unless drained, somewhat poorly drained soils are so wet that crops are damaged in most years. Examples are Slade and Gladwin soils.

The design of subsurface and surface drainage systems varies with the kind of soil. The drains should be more closely spaced in slowly permeable soils than in the more permeable soils. Diversions can be used to direct excess surface runoff away from some wet areas. Good tilth, an ample supply of organic matter, and prevention of subsoil compaction also improve drainage. Most of the soils that require drainage are in low areas where the growing season is shortened by frost late in spring and early in fall. A drainage system can help to extend the growing season because the soils warm more quickly after the wetness is reduced.

Care must be exercised so as not to drain designated wetlands, most of which consist of poorly drained or very poorly drained soils. Draining these soils could violate existing wetland laws and regulations and may jeopardize receipt of USDA benefits. Information about the design of drainage systems for each kind of soil is available in the Field Office Technical Guide, which is on file in the local office of the Natural Resources Conservation Service.

Droughtiness is a limitation in Blue Lake, Islandlake, Kalkaska, Lindquist, and Mancelona soils. The moisture-holding capacity of these soils can be improved by increasing the content of organic matter. Crop production is more reliable when these soils are irrigated. Irrigation improves crop production on most coarse textured soils. Irrigated areas can be used for specialty crops, such as potatoes. Irrigation is feasible in areas where surface water or subsurface water is abundant and is a suitable source and where the soils have a good rate of water intake. Conservation tillage, grassed waterways, and good management of irrigation water are needed to control runoff and erosion and improve the efficiency of the irrigation system.

Soil fertility is naturally low to medium in loamy soils and very low or low in sandy soils. Many sandy soils naturally are moderately acid or slightly acid. Applications of lime are needed to raise the pH level of the plow layer sufficiently for the good growth of alfalfa and other crops that grow best where the pH is near neutral. On all soils, additions of fertilizer and lime should be based on the results of soil tests, on the needs of the crop, and on a reasonable yield goal. Michigan State University Extension can help in determining the kinds and amounts of fertilizer and lime needed (Michigan State University, 1985).

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. Some of the soils used for crops have a surface layer that is light in color and low in content of organic matter, especially in eroded areas. Generally, the

structure of such soils is weak, and intensive rainfall causes the surface to crust. The crusting increases the surface runoff rate and the hazard of erosion and impairs seedling emergence. Regular additions of crop residue, manure, and other organic material improve tilth and help to prevent surface crusting. No-till farming does not destroy worm channels and cracks in the natural soil structure and thus improves water infiltration.

Preventing *soil compaction* is closely related to maintaining soil tilth. Compaction results from operating equipment or allowing heavy animals to graze when the soil is wet. Preventing compaction in loamy and clayey soils is difficult. These soils stay wet until late in spring. If tilled when wet, they become compacted both in the surface layer and in the upper part of the subsoil. They become cloddy when dry. These soils are characterized by a high runoff rate, poor germination, and very irregular crop growth. Cropping systems with a controlled traffic pattern, such as stripcropping, reduce the area that is subject to compaction. Tilling at the proper moisture content is important. Including deep-rooted legumes in the crop rotation and subsoiling when the subsoil is at the proper moisture content help to break up a plowpan. A no-till planting system, over time, also can help to break up a plowpan.

Pasture in the county is generally in areas where erosion is a severe hazard, where the soils are too wet for cultivation, or where the soils are too droughty for cultivated crops. The key forage species include alfalfa and smooth bromegrass on medium textured, well drained soils; alfalfa, red clover, bromegrass, and orchardgrass on coarse textured soils; birdsfoot trefoil and bromegrass on most wet soils; and reed canarygrass on undrained mucks.

Control of erosion is particularly important when a pasture is seeded. Mulch seeding or growing a nurse crop can help to control erosion. The amount of lime and fertilizer to be applied in pastured areas should be determined by a soil test. Grazing during wet periods results in compaction, which retards the growth of pasture plants. Proper grazing methods improve plant growth and help to prevent compaction.

The productivity of a pasture and its ability to protect the soil surface are influenced by the number of livestock that the pasture supports, the length of time that they graze, and the distribution of rainfall. Good pasture management includes stocking rates that maintain the key forage species, pasture rotation, timely deferment of grazing, and strategic location of water and salt supplies for livestock.

Yields per Acre

The average yields per acre that can be expected of the crops grown in the county under a high level of management are shown in tables 5, 6, and 7. In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the tables.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in tables 5, 6, and 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of Michigan State University Extension can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (USDA, 1961). Crops that require special management are excluded. The soils are grouped according to their

limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forestland and for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by numerals 1 through 8. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have few limitations that restrict their use.

Class 2 soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations or hazards that reduce the choice of plants or that require very careful management, or both.

Class 5 soils are not likely to erode but have other limitations or hazards, impractical to remove, that limit their use.

Class 6 soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class 7 soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class 8 soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, forestland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section “Detailed Soil Map Units” and in the yield tables.

Also given at the end of each map unit description is a Michigan soil management group. The soils are assigned to a group according to the dominant profile texture, the natural drainage class, and the major management concerns (Mokma, 1978). More detailed information about these groups is available from the local office of Michigan State University Extension.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation’s short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation’s prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 16,000 acres in the survey area, or nearly 5 percent of the total acreage, meets the soil

requirements for prime farmland. Scattered areas of this land are throughout the county, but most are in the central and the southwestern parts, mainly in associations 8, 9, and 10, which are described under the heading “General Soil Map Units.” About 8,000 acres of this prime farmland is used for crops. The crops grown on this land, mainly corn for silage, potatoes, and hay, account for an estimated two-thirds of the county’s total agricultural income each year.

The map units in the survey area that are considered prime farmland are listed in table 8. This list does not constitute a recommendation for a particular land use. On two of the soils included in the list, measures that overcome wetness are needed. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading “Detailed Soil Map Units.”

Forestland Management and Productivity

Virgin forests once covered almost all of Otsego County. Presently, about 239,600 acres in the county, or 71 percent of the total acreage, is classified as commercial forestland (Leatherberry, 1994). About 130,100 acres, or 54 percent of the forestland, occurs as privately owned tracts, many of which are relatively small. About 84,100 acres, or 35 percent of the forestland, is managed by the State government. About 25,400 acres, or nearly 11 percent of the forestland, is owned and managed by private corporations.

Most of the county consists of forested areas where sugar maple, red maple, red pine, eastern white pine, aspen, northern red oak, jack pine, and northern whitecedar are the dominant tree species. The sandy outwash plains in the southeastern part of the county are most commonly dominated by relatively pure stands of jack pine. The sandy outwash plains and outwash channels in the central and eastern parts of the county are dominated by northern red oak, red pine, eastern white pine, red maple, jack pine, and aspen. Large areas of northern hardwoods, dominantly sugar maple, American beech, and American basswood, occur in the northern half and the southwest corner of the county. The hardwoods generally are on loamy and sandy glacial moraines. Almost 6 percent of the forestland occurs as wetland. Most of the forested wetlands have stands of northern whitecedar, black spruce, tamarack, and balsam fir.

The wood industry is of vital importance to the economy of Otsego County. The harvesting and processing of wood products account for the employment of a large percentage of the workforce. Because of the large amount of forestland in the county and the close proximity to wood-processing industries, the future economy of the county will continue to include forestland products. Proper forestland management, on both public and private lands, will be required to ensure that the desired types of raw materials will be available in sufficient quantity to meet the future demands of the forest industry. Much of the forestland can benefit from measures that improve the timber stands, such as thinning, selective harvesting, planting, and controlling plant competition, insects, and disease. In some areas planting marginal cropland to high-value hardwoods or conifers is economical. The Natural Resources Conservation Service and the Michigan Department of Natural Recourses, Division of Forestry, can help to determine specific management needs.

The most important of the multitude of forest products in the county are pulpwood, sawlogs, and fuelwood (Smith et al., 1988).

Pulpwood.—Otsego County is one of the highest producers of pulpwood in the Lower Peninsula of Michigan. Most of the pulpwood is harvested from even-aged stands of northern hardwoods, which are mature or overly mature. These stands originated from large-scale fires following the logging era, near the turn of the 19th century. Pulpwood production will remain important in the future because the county is close to high-volume mills.

Sawlogs.—Sawlogs are harvested when they are sorted out during commercial pulpwood logging operations, which are generally clear-cut operations. Few of the logs are of veneer quality, but some are shipped out of the county for processing. Most of the logs are of lower quality and generally are made into low-quality lumber or pallets. Some of the plantations and naturally occurring stands of red pine are managed for high-quality lumber, utility poles, or logs for log homes. Many stands of northern hardwoods are managed for high-quality long-term sawlog production and veneer by single tree selection harvesting methods.

Fuelwood.—Many of the hardwoods cut in the county are used to supply the fuelwood market. This market provides a strong demand for material that would otherwise have a low market value. Many of the households in the county use wood as either a primary or secondary heat source. Much of the fuelwood is being directed to several wood-using

energy plants in the surrounding counties. These plants produce electricity from steam-driven turbines that use wood as a fuel source.

In Otsego County, tree planting is a popular form of reforestation, wildlife habitat development, and erosion control. The following paragraphs describe factors that affect successful tree planting (USDA, 1998).

Site preparation is necessary to eliminate competition, for moisture and nutrients, from the existing ground cover. There are two major types of site preparation—chemical and mechanical. Each of these has advantages and disadvantages. Chemical site preparation is fast, and if properly done, provides long-term release from competition. Depending on the soil type, however, various precautions are necessary. First, reading the label and following the directions are always essential. There is a potential for herbicide leaching into the ground water, and precautions should be taken for the following conditions:

- A low content of organic matter in the surface layer. The organic matter adsorbs the herbicides and helps to prevent leaching losses. If there is no organic matter, some leaching will occur.
- A water table within a depth of 4 feet. In this instance there is little soil to act as a filter should the herbicide be leached below the root zone before reaching the water table.
- Soils with a permeability of more than 6 inches per hour in the top 5 feet. This condition would allow rapid seepage of the herbicide into the water table.
- Soils that have a moderate or severe hazard of water erosion and soils that are occasionally flooded or frequently flooded. These soils are at risk for the loss of herbicides through erosion or runoff.

Mechanized site preparation and planting involve the physical removal of competing plants or the installation of a barrier to prevent competition from the existing ground cover. Identification of the site-specific problems involving depth to the water table, available water capacity, texture of the surface layer, and slope is necessary in choosing the most effective mechanical treatment. Examples of kinds of mechanical treatment follow:

- Bedding for a high water table, which involves preparation of a raised bed that elevates the root zone above the seasonal high water table.
- Slot planting in areas with a thin surface layer, a low content of organic matter, or low fertility. This treatment is suitable in areas where removal of the fertile topsoil is contraindicated and plant competition is minimal. It can be used in conjunction with chemical site preparation.
- Furrow planting in areas where plant competition is severe and natural fertility is adequate. A furrow is plowed, and the sod is removed. The seedlings are then planted in the bottom of the furrow. Establishing the furrows on the contour helps to control water erosion in sloping areas.
- Scalping of the ground cover and planting by hand in areas where operating machines is difficult because of slope or tree-harvesting residue and in areas where the number of seedlings is small.
- Installation of a physical barrier as an alternative to chemical weed control. Methods include installing weed barrier cloth or mulching to control plant competition. Properly installed, this is a long-term, economical method of controlling plant competition. It increases the amount of moisture available to the seedlings.

In most instances bare-root seedlings are adequate for reforestation. They should be of good quality, and in general the larger and older seedlings are a better choice. Because of the need for adequate moisture for survival, this type of seedling should be planted early in spring or in fall.

In areas of adverse site conditions, containerized seedlings or transplants are more likely to survive than other seedlings. Adverse site conditions include a sandy texture, a low content of organic matter, low natural fertility, a low available water capacity, excessive and somewhat excessive drainage, and steep south-facing slopes.

The planting method affects seedling selection and survival. Planting large conifer seedlings and most hardwoods by machine is difficult because of the large root mass. Care must be taken to prevent J root. In some cases root pruning may be necessary to facilitate planting. If the stock is very large, hand planting may be the best method.

The conifers and hardwoods selected for planting should be those that are able to adapt to the site. In general, the more adverse the site conditions, the smaller the selection of compatible species (Pregitzer et al., 1987). Following are the species suitable on various kinds of soil:

- Sandy soils that are excessively drained and have a very low level of fertility: jack pine
- Sandy soils that are somewhat excessively drained and have a low level of fertility: jack pine and red pine

- Sandy soils that are well drained and have a low level of fertility: eastern white pine, red pine, northern red oak, and red maple
- Sandy soils that are well drained or moderately well drained and have a moderate level of fertility: eastern white pine, red pine, northern red oak, red maple, white spruce, and balsam fir
- Sandy soils that are somewhat poorly drained or poorly drained: white ash, black ash, red maple, sugar maple, and eastern white pine
- Loamy soils that are well drained and have a low level of fertility: eastern white pine, red pine, white spruce, balsam fir, northern red oak, and red maple
- Loamy soils that are well drained and have a moderately low level of fertility: eastern white pine, red pine, balsam fir, white spruce, red maple, sugar maple, and yellow birch
- Loamy soils that are well drained and have a moderate level of fertility: eastern white pine, red maple, sugar maple, and American basswood
- Loamy soils that are well drained and have a high level of fertility: white ash, sugar maple, and American basswood
- Loamy soils that are moderately well drained or somewhat poorly drained: balsam fir, white spruce, northern whitecedar, red maple, and sugar maple
- Clayey soils: white spruce, balsam fir, northern whitecedar, and sugar maple
- Low-acid, mucky soils: northern whitecedar, balsam fir, black spruce
- Highly acid, mucky soils: tamarack and black spruce

Table 9 can be used by forestland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce in a pure stand under natural conditions. The number 1 indicates low potential productivity; 2 or 3, moderate; 4 or 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; *L*, low strength; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, D, C, S, F, L, and N.

In table 9, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in forestland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that

seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The *site index* is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that forestland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. The volume is determined through the use of standard yield tables.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Suggested trees to plant are those that are suitable for commercial wood production.

Equipment Limitations on Forestland

Timber harvesting is an important part of the economy in Otsego County. Because of the emphasis on logging in the county, table 10 was designed to give expanded information concerning the operability of harvesting equipment on the soils of the county beyond the interpretations listed in the column “Equipment limitation” in table 9. Table 10 shows how soil conditions may improve during the year and indicates the best time for harvesting or thinning operations.

Table 10 gives information about the use of harvesting or thinning equipment in logging areas and on skid roads, log landings (fig. 15), and logging roads. A rating of *slight* indicates that equipment operability is not restricted for normal logging equipment and procedures. A rating of *moderate* indicates that equipment operability is moderately restricted because of one or more soil factors. If the soil is wet, the use of high floatation equipment or special procedures may be required to overcome the effects of soil rutting. A rating of *severe* indicates that the kind of equipment that can be used is severely restricted.

Ratings are given for the *most limiting season(s)* and the *preferred operating season(s)*. The latter show how soil conditions may improve if logging operations are conducted during the preferred operating season. The most limiting season in Otsego County generally is spring or late fall. In some areas, however, it is during the dry period in summer when loose sand can limit trafficability on deep, well drained, sandy soils. The preferred operating season is the period when harvesting or thinning causes the least amount of soil damage. This period generally occurs when the soil is not too wet or when the ground is frozen or partly frozen and has an adequate snow cover.

Logging areas and skid roads include areas that are being partially or completely cut. Generally, the frequency of equipment use is at its lowest in the logging area. Skid roads, which are generally located within the logging area, are roads or trails over which logs are dragged or hauled from the stump to a landing.

Log landings are areas where logs are assembled for transportation in loads. The frequency of wheeled equipment use may be at its highest in these areas.

Haul roads are access roads, leading from primary or surfaced roads into the logging area. These roads serve as transportation routes for wheeled logging

Figure 15.—A log landing in an area of Blue Lake loamy sand, 0 to 6 percent slopes.

equipment and logging trucks. Generally, these are unpaved roads. They may be graveled.

Plant Communities on Selected Soils

Table 11 lists plants that are typically associated with soils in Otsego County. Plants are listed in table 11 on the basis of sample site information. Sample sites were selected for vegetative analysis after detailed soil maps and soil series descriptions were completed in an area. Once the soils were verified, representative vegetative communities were selected. The sample sites are in areas that are relatively free of recent disturbances, such as fire, tree harvesting, or noticeable insect or disease infestations, and that exhibit typical stocking densities.

The sample sites were approximately 10,000 square feet in size. Plant species were identified and recorded, and an ocular estimate was made of the percent coverage for each species. The percentage of canopy coverage was estimated for tree species, and the percentage of ground coverage was estimated for other plants. Coverage values were grouped into seven classes to facilitate compilation and to clarify results. The seven classes are:

Class 1—less than 1 percent coverage
Class 2—1 to 5 percent coverage
Class 3—5 to 25 percent coverage
Class 4—25 to 50 percent coverage
Class 5—50 to 75 percent coverage
Class 6—75 to 95 percent coverage
Class 7—95 to 100 percent coverage

The number after each plant species in table 11 represents the mean coverage class for that species for the map unit component listed. This number can be correlated to the relative dominance of overstory and understory vegetation. Plants that have a high number cover more of the canopy or ground than those with a low number.

The plants listed in table 11 for each map unit were selected on the basis of information from 2 to 10 sample sites. They are considered the typical plants in the map unit, but they are not the only

plants in the map unit (Voss, 1972, 1985, 1996). Only the common plant names are shown in table 11. The common names are those on a national list of plant names (USDA, National list of common plant names).

Windbreaks and Environmental Plantings

Farmstead windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 12 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 12 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or of Michigan State University Extension or from a commercial nursery.

Recreation

Otsego County provides year-round opportunities for outdoor recreation because of a combination of rolling forestland, 80 lakes, 5 major rivers, numerous streams, and the crisp, clean air of unspoiled wilderness areas. The recreational activities include mushroom hunting in spring, fishing and water sports in summer, hunting in autumn, and snow fun in winter.

Otsego County has become the Midwest golf mecca with over 21 championship courses. With an average winter snowfall of more than 150 inches, the county has three downhill ski resorts (fig. 16), nine cross-country ski areas, and almost 450 miles of snowmobile trails. Elk viewing, bird watching, trout fishing, hiking, hunting, camping, and horseback riding are popular activities in the 96,000-acre Pigeon River State Forest. Other activities include canoeing, boating, picnicking, and swimming. Popular attractions include Otsego Lake State Park, Otsego Lake County Park, and 17 public access sites on inland lakes. Other recreational areas include seven State forest campgrounds, a State park campground, a county campground, and two private campgrounds (Traverse, 1994).

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 13, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 13 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 16 and interpretations for dwellings without basements and for local roads and streets in table 15.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders,

Figure 16.—A ski hill in an area of Menominee-Bamfield, sandy substratum-Blue Lake complex, 18 to 70 percent slopes, dissected.

absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Otsego County has a diversity of wildlife habitat and wildlife species. Woodland habitat is dominant in the county. It provides food and shelter for common upland game animals, such as elk, white-tailed deer, snowshoe hare, cottontail rabbit, gray squirrel, and fox squirrel. Black bear, coyote, red fox, gray fox, porcupine, badger, striped skunk, woodchuck, raccoon, red squirrel, flying squirrel, and opossum also inhabit the county. Common upland game birds

include ruffed grouse, woodcock, snipe, and wild turkey. The county has a multitude of hawks, owls, and songbirds.

The Pigeon River State Forest, in the northeastern part of the county, is home to the Michigan elk herd, the largest elk herd west of the Mississippi River. The herd has a population of about 1,000, which is maintained by limitations on hunting and by habitat improvement projects. There are many viewing areas within the forest at various wildlife openings and along forest trails. The best viewing times are at dawn and dusk, in spring and fall. In fall, the bull elk are bulging to attract or protect their harems of cows.

Kirtland's warbler is an endangered songbird that inhabits Otsego County. The preferred nesting habitat for this bird is young jack pine forests. Habitat improvement projects have been established on State forestlands to attract and maintain continual nesting populations. The threatened bird species in the county include the bald eagle, osprey, and common loon.

Most of the woodland habitat in the county can be improved by increasing the amount of available food and cover. Planting forestland openings to grasses, small grain crops, and food-producing shrubs can increase the amount of available food. Planting conifers, thick shrubs, and shelterbelts can improve the available cover.

The various rivers, creeks, and lakes in the county provide habitat for a variety of fish. The Au Sable, Manistee, Sturgeon, Pigeon, and Black Rivers and some of the creeks have a good population of brook trout and brown trout. Otsego Lake offers habitat for sturgeon, and muskellunge. All of the lakes offer habitat for common game fish, such as northern pike, walleye, smallmouth bass, largemouth bass, and trout. Common panfish include crappie, perch, and bluegill.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 14, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, wheat, oats, rye, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are big bluestem, goldenrod, violets, cowwheat, and Pennsylvania sedge.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, aspen, cherry, beech, apple, hawthorn, dogwood, maple, blackberry,

and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and yew.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are bog laurel, cattail, jewelweed, Labrador tea, marsh marigold, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include woodchuck, ground squirrel, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous and/or coniferous plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are beaver, bobcat, muskrat, mink, otter, various diving ducks, dabbling ducks, Canada geese, herons, and shore birds.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and the data in the tables described under the heading "Soil Properties."

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, roadfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in

this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 15 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the content of stones, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the AASHTO group index number), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 16 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 16 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties,

site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 16 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 16 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones, highly organic layers, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, rock fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 17 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting

suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 17, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel and stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its content of organic matter. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 18 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to

overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering properties, physical and chemical properties, and pertinent soil and water features.

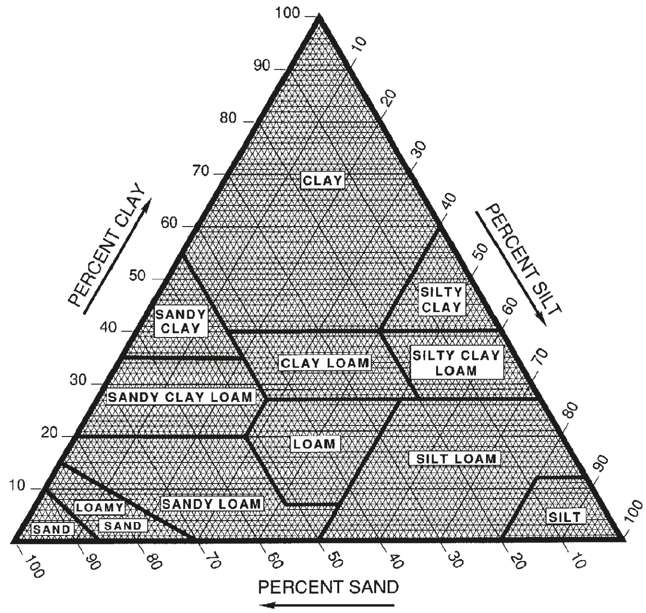

Figure 17.—Percentages of sand, silt, and clay in the basic USDA soil texture classes.

Engineering Index Properties

Table 19 gives estimates of the engineering classification and of the range of engineering properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given under the heading “Soil Series and Their Morphology.”

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 17). “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2001) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2000).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and content of organic matter. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the

basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical Properties

Table 20 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given under the heading “Soil Series and Their Morphology.”

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Bulk densities of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (K_{sat}) refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility, or shrink-swell potential, is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil.

The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, 6 to 9 percent; and *very high*, more than 9 percent.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 20, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factors are shown in table 20 as the K factor and the T factor. *Erosion factor K* indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor K indicates the erodibility of the whole soil, and erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in diameter. For most soils, Kf equals K. If substantial amounts of rock fragments have an armoring effect, the K factor should be adjusted downward. Therefore, the K factor will be less than Kf. Because of armoring, there is less splash erosion on gravelly soils.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of the soil to wind erosion. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are defined in the “National Soil Survey Handbook” (USDA, 2002).

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Properties

Table 21 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given under the heading “Soil Series and Their Morphology.”

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable bases plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5. Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by

laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Water Features

Tables 22 and 23 give estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups, which are shown in tables 22 and 23, are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The *months* identified in table 22 indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 22 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 22 indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Table 23 gives estimates of the fluctuating water content in the soils in Otsego County. Soil moisture status greatly influences the type of vegetation and plant growth; physical properties of soils, such as permeability, workability, strength, linear extensibility, and frost action; and chemical interactions and transport. Many other properties, qualities, and interpretations also are affected. Soil moisture status is important in the classification of soils, wetland, and habitat.

Table 23 gives estimates of soil moisture for each soil in the county at various depths for every month of the year. The depths displayed are representative values that are indicative of conditions that occur most of the time. *Dry* indicates a moisture condition under which most plants (especially crops) cannot extract water for growth. *Moist* indicates a moisture condition under which soil water is most readily available for plant growth. *Wet* indicates a condition under which water will stand in an unlined hole or at least a condition under which the soil is too wet for the growth of most agricultural species. A rating of “0.0-6.5: Moist” indicates that, in a typical year, the soil is moist from the surface to a depth of 6.5 feet during the month designated. Summer months may show the effects of drying plus intermittent light rains. This combination could produce a moist layer over a dry layer that gets moist again.

Soil Features

Table 24 gives estimates of important soil features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 24 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Hydric Soils

In this section, hydric soils are defined and described and the hydric soils in the survey area are listed.

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin et al., 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995;

Tiner, 1985). Criteria for each of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 1995). These criteria are used to identify a phase of a soil series that normally is associated with wetlands. The criteria used are selected estimated soil properties that are described in “Soil Taxonomy” (Soil Survey Staff, 1999) and “Keys to Soil Taxonomy” (Soil Survey Staff, 1998) and in the “Soil Survey Manual” (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils in this survey area are specified in “Field Indicators of Hydric Soils in the United States” (Hurt et al., 1998).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

The following map units meet the definition of hydric soils and, in addition, have at least one of the hydric soil indicators. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt et al., 1998).

13	Tawas-Lupton mucks
14	Dawson-Loxley peats
19	Leafriver muck
23	Ausable-Bowstring mucks, frequently flooded
24A	Kinross-Au Gres complex, 0 to 3 percent slopes (the Kinross soil)
50B	Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes (the Kinross soil)
51	Tawas-Leafriver mucks
86	Histosols and Aquents, ponded
87	Ausable muck, frequently flooded
113	Angelica loam
127	Cathro muck
352B	Deford-Au Gres-Croswell complex, 0 to 6 percent slopes (the Deford soil)
360	Wakeley muck
368A	Au Gres-Deford complex, 0 to 3 percent slopes (the Deford soil)
369	Deford muck
465	Caffey muck

Map units that are made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1998 and 1999). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 25 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Spodosol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Orthod (*Orth*, meaning other, plus *od*, from Spodosol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplorthod (*Hapl*, meaning minimal horizonation, plus *orthod*, the suborder of the Spodosols that has a horizon characterized by an accumulation of aluminum, iron, and organic carbon in which no one of the elements dominates).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplorthods.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, frigid Typic Haplorthods.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Some higher category soils, such as Aquents, also are described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” (Soil Survey Staff, 1999) and in “Keys to Soil Taxonomy” (Soil Survey Staff, 1998). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

Angelica Series

The Angelica series consists of poorly drained soils in depressions on moraines. These soils formed in thick deposits of loamy material. Permeability is

moderate in the upper part of the profile and moderately slow in the underlying till. Slope ranges from 0 to 2 percent.

Taxonomic classification: Fine-loamy, mixed, nonacid, semiactive, frigid Aeric Endoaquepts

Typical pedon of Angelica loam, on a 1 percent north-facing slope in a forested area; at an elevation of 1,116 feet; 1,170 feet north and 335 feet west of the southeast corner of sec. 13, T. 32 N., R. 2 W.; Corwith Township; USGS Hardwood Lake Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 09 minutes 32.30 seconds N. and long. 84 degrees 29 minutes 30.41 seconds W., NAD 27:

A—0 to 8 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; friable; many fine and medium and few coarse roots; about 2 percent gravel; slightly acid; abrupt wavy boundary.

Bg—8 to 10 inches; 60 percent grayish brown (2.5Y 5/2) and 40 percent reddish brown (5YR 4/4) loam; strong coarse subangular blocky structure; friable; common fine and medium roots; common fine yellowish red (5YR 5/6) masses of iron accumulation in the matrix; about 2 percent gravel; slightly acid; abrupt wavy boundary.

Bw—10 to 20 inches; reddish brown (5YR 4/4) clay loam; strong coarse subangular blocky structure; firm; few fine roots; common prominent dark gray (5Y 4/1) clay films in root channels; many coarse prominent gray (5Y 5/1) iron depletions on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

C1—20 to 38 inches; brown (7.5YR 5/4) clay loam; massive; firm; common fine prominent yellowish red (5YR 5/8) masses of iron accumulation in the matrix; about 5 percent gravel; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2—38 to 60 inches; reddish brown (5YR 5/3) clay loam; massive; firm; common medium prominent gray (5Y 5/1) iron depletions in the matrix; about 5 percent gravel; strongly effervescent; moderately alkaline.

The depth to carbonates ranges from 14 to 20 inches. The content of gravel ranges from 0 to 10 percent and the content of cobbles from 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 or 1.

The Bg horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2. It is loam or sandy loam.

The Bw horizon has hue of 7.5YR or 5YR and value and chroma of 4. It is sandy clay loam, clay loam, or sandy loam.

The C horizon has hue of 7.5YR or 5YR, value of 5, and chroma of 2 to 4. It is clay loam with less than 35 percent clay.

Aquents

These are mixed, frigid Aquents that consist of very poorly drained, rapidly permeable to slowly permeable soils on outwash plains and moraines. These soils formed in sandy to clayey glaciofluvial material. Slope is 0 to 1 percent.

The surface layer is typically black (10YR 2/1) muck or mucky peat 3 to 16 inches thick.

The upper part of the mineral material has hue of 10YR, 2.5YR, or 5Y, value of 5 or 6, and chroma of 1 to 3. The mineral material ranges from sand to clay.

Au Gres Series

The Au Gres series consists of somewhat poorly drained soils on stream terraces and outwash plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 3 percent.

Taxonomic classification: Sandy, mixed, frigid Typic Endoaquods

Typical pedon of Au Gres sand, 0 to 3 percent slopes, on a 1 percent southeast-facing slope in a forested area; at an elevation of 1,275 feet; 750 feet south and 25 feet east of the northwest corner of sec. 36, T. 29 N., R. 4 W.; south part of Hayes Township; USGS Big Bradford Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 52 minutes 15.75 seconds N. and long. 84 degrees 44 minutes 45.21 seconds W., NAD 27:

A—0 to 3 inches; black (N 2.5/0) sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine, medium, and coarse roots; strongly acid; abrupt wavy boundary.

E—3 to 9 inches; brown (7.5YR 5/2) sand, light gray (10YR 7/2) dry; weak very fine subangular blocky structure; very friable; many fine, medium, and coarse roots; strongly acid; abrupt wavy boundary.

Bs1—9 to 11 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; common fine and medium and few coarse roots; common medium distinct strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; 10 percent moderately cemented dark reddish brown

(5YR 3/3) ortstein occurring as columns 2 to 4 inches wide and extending into the Bs2 horizon; strongly acid; abrupt irregular boundary.

Bs2—11 to 22 inches; dark yellowish brown (10YR 4/6) sand; weak fine subangular blocky structure; very friable; few fine and medium roots; common medium prominent yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; 10 percent weakly cemented dark reddish brown (5YR 3/3) ortstein occurring as columns 2 to 4 inches wide; moderately acid; clear wavy boundary.

BC—22 to 42 inches; yellowish brown (10YR 5/4) sand; weak fine subangular blocky structure; very friable; common fine distinct brown (7.5YR 4/4) and strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

C—42 to 80 inches; brown (10YR 5/3); sand; single grain; loose; about 7 percent fine and medium gravel; moderately acid.

The content of gravel ranges from 3 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 or 1. Reaction ranges from extremely acid to slightly acid.

The E horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 2. Reaction is very strongly acid or strongly acid.

The Bs1 horizon has hue of 7.5YR, value of 3 or 4, and chroma of 4. The content of ortstein ranges from 0 to 10 percent. Reaction ranges from very strongly acid to moderately acid.

The Bs2 horizon has hue of 10YR, value of 3 or 4, and chroma of 4 to 6. The content of ortstein ranges from 0 to 10 percent. Reaction ranges from very strongly acid to moderately acid.

The BC horizon has hue of 10YR, value of 5, chroma of 4 or 5. The content of ortstein ranges from 0 to 10 percent. Reaction is strongly acid or moderately acid.

The C horizon has hue of 5YR to 5Y, value of 5 or 6, and chroma of 2 to 4. In some pedons it has thin strata of gravelly sand. Reaction ranges from strongly acid to neutral.

Ausable Series

The Ausable series consists of very poorly drained soils on flood plains. These soils formed in thin organic layers and in sandy alluvium. Permeability is moderate or moderately rapid in the organic material and rapid in the sandy material. Slope ranges from 0 to 2 percent.

Taxonomic classification: Sandy, mixed, frigid Histic Humaquepts

Typical pedon of Ausable muck, in an area of Ausable-Bowstring mucks, frequently flooded; on a 1 percent slope in an area of willows on a flood plain; at an elevation of 1,219 feet; 2,210 feet south and 2,510 feet east of the northwest corner of sec. 31, T. 29 N., R. 4 W.; south part of Hayes Township; USGS Frederic Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 52 minutes 01.73 seconds N. and long. 84 degrees 50 minutes 16.75 seconds W., NAD 27:

Oa1—0 to 5 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material), black (N 2.5/0) dry; about 20 percent fiber broken face, 5 percent rubbed; moderate medium subangular blocky structure; very friable; common fine, medium, and coarse roots; neutral; clear wavy boundary.

Oa2—5 to 10 inches; very dark grayish brown (10YR 3/2) (broken face and rubbed) muck (sapric material); about 10 percent fiber broken face, 2 percent rubbed; moderate medium subangular blocky structure; very friable; common fine and medium roots; neutral; abrupt wavy boundary.

Cg—10 to 18 inches; grayish brown (10YR 5/2) sand with layers of black (N 2.5/0) muck $^1/_8$ to $^3/_4$ inch thick; single grain; loose; neutral; clear wavy boundary.

C—18 to 46 inches; light olive brown (2.5Y 5/4) sand; single grain; loose; common fine prominent strong brown (7.5YR 4/6 and 5/8) masses of iron accumulation in the matrix; neutral; abrupt wavy boundary.

O´a—46 to 52 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material); about 10 percent fiber broken face, 2 percent rubbed; moderate medium subangular blocky structure; very friable; slightly alkaline; abrupt wavy boundary.

C´—52 to 80 inches; light olive brown (2.5Y 5/4) sand with strata of gravel; single grain; loose; common medium prominent strong brown (7.5YR 4/6 and 5/8) masses of iron accumulation in the matrix; about 8 percent fine and medium gravel; slightly alkaline.

Thin bands of organic material occur in the control section. The organic material is dominantly sapric but has as much as 10 percent woody fragments. Reaction is moderately acid to slightly alkaline throughout the profile.

The Oa and O´a horizons have hue of 7.5YR or 10YR or are neutral in hue. They have value of 2 to 3 and chroma of 0 to 2.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 1 to 4. In some pedons it has bands of organic material $^{1}/_{8}$ inch to 2 inches thick. The texture is sand or gravelly sand. The content of gravel ranges from 0 to 17 percent.

Bamfield Series

The Bamfield series consists of well drained soils on moraines. These soils formed in loamy till overlying sandy material (fig. 18). Permeability is moderately slow in the overlying till and rapid in the underlying sandy material. Slope ranges from 12 to 70 percent.

Figure 18.—Typical profile of a Bamfield fine sandy loam. Depth is marked in inches.

Taxonomic classification: Fine-loamy, mixed, active, frigid Haplic Glossudalfs

Typical pedon of Bamfield fine sandy loam, sandy substratum, 12 to 18 percent slopes, on a 17 percent southwest-facing slope in a wooded area; at an elevation of 1,375 feet; 670 feet north and 2,350 feet west of the southeast corner of sec. 1, T. 30 N., R. 1 W.; central part of Charlton Township; USGS Hetherton Michigan 7.5-minute topographic quadrangle; lat. 54 degrees 00 minutes 53.22 seconds N. and long. 84 degrees 22 minutes 44.05 seconds W., NAD 27:

A—0 to 5 inches; black (N 2.5/0) fine sandy loam, very dark gray (10YR 3/1) dry; strong coarse granular structure; very friable; many fine and common medium and coarse roots; about 3 percent gravel; slightly acid; abrupt wavy boundary.

Bw—5 to 11 inches; brown (10YR 4/3) sandy loam; moderate medium subangular blocky structure; very friable; many fine, common medium, and few coarse roots; common prominent black (N 2.5/0) earthworm casts; about 3 percent gravel; slightly acid; clear wavy boundary.

E—11 to 20 inches; grayish brown (10YR 5/2) sandy loam, light brownish gray (10YR 6/2) dry; moderate coarse subangular blocky structure; friable, hard and brittle when dry; few fine, medium, and coarse roots; common very fine and fine vesicular pores; about 3 percent gravel; moderately acid; clear wavy boundary.

E/B—20 to 23 inches; 70 percent grayish brown (10YR 5/2) sandy loam (E), light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable, hard and brittle when dry; common very fine and fine vesicular pores; E material surrounding brown (7.5YR 4/4) clay loam (Bt); moderate medium subangular blocky structure; firm; few fine, medium, and coarse roots; few fine continuous tubular pores; patchy prominent dark reddish brown (5YR 3/3) clay films on faces of peds and in pores and root channels; about 3 percent gravel; moderately acid; clear wavy boundary.

Bt—23 to 39 inches; brown (7.5YR 4/4) clay loam; weak medium prismatic structure parting to strong coarse angular blocky; firm; few fine, medium, and coarse roots; few very fine and fine continuous vertical tubular pores; continuous prominent dark reddish brown (5YR 3/3) clay films on faces of peds and in pores; few fine prominent black (N 2.5/0) organic stains on faces of peds and in root channels; about 5 percent

gravel and 1 percent cobbles; neutral; clear irregular boundary.

BC—39 to 51 inches; brown (7.5YR 4/4) clay loam; moderate medium angular blocky structure; firm; few medium roots; very few very fine and fine continuous vertical tubular pores; few discontinuous prominent dark reddish brown (5YR 3/3) clay films on faces of peds; about 5 percent gravel and 1 percent cobbles; strongly effervescent; moderately alkaline; clear irregular boundary.

C1—51 to 64 inches; brown (7.5YR 4/4) clay loam; weak medium platy structure derived from deposition; firm; few fine faint light brown (7.5YR 6/4) coatings of carbonate on faces of peds; about 5 percent gravel and 1 percent cobbles; violently effervescent; moderately alkaline; abrupt smooth boundary.

2C2—64 to 80 inches; light yellowish brown (10YR 6/4), stratified sand and gravelly sand; single grain; loose; 5 to 20 percent gravel in individual strata; slightly effervescent; slightly alkaline.

The depth to carbonates ranges from 26 to more than 60 inches. The content of gravel ranges from 1 to 14 percent in the upper loamy material and from 1 to 20 percent in the lower sandy material. The content of cobbles ranges from 0 to 5 percent throughout the profile. Reaction ranges from slightly acid to slightly alkaline in the upper part of the profile and is slightly alkaline or moderately alkaline in the substratum.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2. Reaction ranges from slightly acid to strongly acid. Some pedons have an Ap horizon.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 5. It is sandy loam or fine sandy loam. Reaction ranges from slightly acid to strongly acid.

The E horizon and the E part of the E/B or B/E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3. They are sandy loam or fine sandy loam. Reaction is slightly acid or moderately acid.

The Bt horizon and the B part of the E/B or B/E horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. They are loam, clay loam, or sandy clay loam with a clay content between 27 and 35 percent. Reaction ranges from slightly acid to slightly alkaline.

The BC and C horizons have hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 3 or 4. They are loam, clay loam, or sandy clay loam. Reaction is moderately alkaline.

The 2C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 5. It is stratified sand, loamy sand, or the gravelly analogs of those textures. Reaction is slightly alkaline.

Blue Lake Series

The Blue Lake series consists of well drained soils on moraines and outwash plains. These soils formed in thick deposits of sandy material. Permeability is moderately rapid. Slope ranges from 0 to 70 percent.

Taxonomic classification: Sandy, mixed, frigid Lamellic Haplorthods

Typical pedon of Blue Lake loamy sand, 0 to 6 percent slopes, on a 3 percent southeast-facing slope in a forested area; at an elevation of 1,362 feet; 640 feet north and 100 feet west of the southeast corner of sec. 27, T. 30 N., R. 4 W.; north part of Hayes Township; USGS Lake Arrowhead Michigan 7.5 minute topographic quadrangle; lat. 44 degrees 57 minutes 43.55 seconds N. and long. 84 degrees 46 minutes 06.28 seconds W., NAD 27:

A—0 to 3 inches; black (10YR 2/1) loamy sand, very dark gray (N 3/0) dry; weak coarse granular structure; very friable; common fine, medium, and coarse roots; very strongly acid; clear wavy boundary.

E—3 to 7 inches; grayish brown (10YR 5/2) sand, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; very friable; common fine and medium roots; strongly acid; clear irregular boundary.

Bs1—7 to 15 inches; dark reddish brown (5YR 3/4) sand; weak fine subangular blocky structure; friable; common medium roots; 15 percent weakly cemented dark reddish brown (5YR 3/2) ortstein occurring as columns 2 to 4 inches wide and extending into the Bs2 horizon; about 3 percent gravel and 5 percent cobbles; strongly acid; gradual wavy boundary.

Bs2—15 to 26 inches; brown (7.5YR 4/4) sand; weak very fine subangular blocky structure; very friable; 10 percent weakly cemented dark reddish brown (5YR 3/3) ortstein occurring as columns 1 to 3 inches wide; about 3 percent gravel and 5 percent cobbles; strongly acid; gradual wavy boundary.

E and Bt—26 to 80 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; lamellae of brown (7.5YR 5/4) loamy sand (Bt) that are 1/8 inch to 2 inches thick and have a total thickness of more than 6 inches; moderate very fine

subangular blocky structure; very friable; clay bridging between sand grains in the lamellae; strongly acid.

Depth to the E and Bt horizon ranges from 21 to 38 inches. The content of cobbles ranges from 0 to 5 percent and the content of gravel from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 3, and chroma of 1 or 2. Some pedons have an Ap horizon, which has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2. The A and Ap horizons are loamy sand or sand.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2. Reaction is strongly acid. The texture is loamy sand or sand.

Some pedons have a Bhs horizon. This horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3. Reaction is strongly acid. The texture is loamy sand or sand.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 4 to 6. Reaction is strongly acid. The texture is loamy sand or sand.

The E part of the E and Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. Reaction is strongly acid or moderately acid.

The Bt part of the E and Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 5. The lamellae range from 1/8 inch to 6 inches in thickness. Reaction is strongly acid or moderately acid. The texture is loamy sand or sandy loam.

Some pedons have a C horizon. This horizon has hue of 7.5YR or 10YR, value of 6, and chroma of 3. Reaction ranges from moderately acid to neutral.

Bowstring Series

The Bowstring series consists of very poorly drained soils on flood plains. These soils formed in highly decomposed organic material that is stratified with thin layers of sandy alluvium. Permeability is moderately slow to rapid. Slope is 0 to 1 percent.

Taxonomic classification: Euic, frigid Fluvaquentic Haplosaprists

Typical pedon of Bowstring muck, in an area of Ausable-Bowstring mucks, frequently flooded; on a hummocky flood plain with a plant cover that is mostly sedges; at an elevation of 1,224 feet; 1,170 feet north and 2,010 feet west of the southeast corner of sec. 8, T. 29 N., R. 2 W.; south part of Chester Township; USGS Turtle Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 55 minutes 04.12 seconds N. and long. 84 degrees 34 minutes 27.49 seconds W., NAD 27:

Oa1—0 to 9 inches; black (10YR 2/1) (broken face and rubbed) muck (sapric material); 60 percent herbaceous fiber broken face, 10 percent rubbed; moderate fine angular blocky structure; friable; many fine and medium and common coarse roots; slightly acid; clear wavy boundary.

Oa2—9 to 24 inches; very dark brown (10YR 2/2) (broken face and rubbed) muck (sapric material); 40 percent herbaceous fiber broken face, 5 percent rubbed; moderate medium subangular blocky structure; very friable; common fine and medium roots; neutral; clear wavy boundary.

Oa3—24 to 44 inches; dark brown (7.5YR 3/2) (broken face and rubbed) muck (sapric material); 20 percent herbaceous fiber broken face, 2 percent rubbed; weak medium subangular blocky structure; very friable; neutral; abrupt wavy boundary.

Cg—44 to 50 inches; 70 percent dark grayish brown (2.5Y 4/2) sand; single grain; loose; very friable; about 3 percent fine and medium gravel; 30 percent black (N 2.5/0) (broken face and rubbed) muck (sapric material) in layers 1/8 to 1/2 inch thick; massive; friable; 10 percent herbaceous fiber broken face, 2 percent rubbed; neutral; abrupt smooth boundary.

O´a—50 to 54 inches; dark brown (7.5YR 3/2) (broken face and rubbed) muck (sapric material); 20 percent herbaceous fiber broken face, 2 percent rubbed; weak medium subangular blocky structure; very friable; neutral; abrupt smooth boundary.

C´g1—54 to 65 inches; 70 percent dark grayish brown (2.5Y 4/2) sand; single grain; loose; 30 percent black (N 2.5/0) (broken face and rubbed) muck (sapric material) in layers 1/8 to 1 inch thick; massive; friable; 10 percent herbaceous fiber broken face, 2 percent rubbed; about 3 percent fine and medium gravel; neutral; abrupt smooth boundary.

C´g2—65 to 80 inches; grayish brown (2.5Y 5/2); sand; single grain; loose; common fine distinct gray (N 5/0) iron depletions; about 3 percent fine and medium gravel; slightly alkaline.

The organic material ranges from 16 to more than 51 inches in thickness. The depth to thin layers of mineral soil material ranges from 23 to 44 inches. Reaction ranges from slightly acid to slightly alkaline throughout the profile.

The Oa and O´a horizons have hue of 10YR or 7.5YR or are neutral in hue. They have chroma of 0 to 2.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 or 3. The content of gravel ranges from 0 to 3 percent.

Caffey Series

The Caffey series consists of very poorly drained soils on moraines and lake plains. These soils formed in sandy material underlain by stratified loamy material. Permeability is rapid in the sandy material and moderately slow in the loamy material. Slope ranges from 0 to 2 percent.

Taxonomic classification: Sandy over loamy, mixed, nonacid, semiactive, frigid Aeric Endoaquents

Typical pedon of Caffey muck, on a 2 percent northwest-facing slope in a pasture; at an elevation of 1,115 feet; 670 feet north and 2,180 feet west of the southeast corner of sec. 13, T. 31 N., R. 3 W.; Livingston Township; USGS Sparr Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 04 minutes 20.54 seconds N. and long. 84 degrees 37 minutes 52.43 seconds W., NAD 27:

Oa—0 to 6 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material); 5 percent intermixed light brownish gray (10YR 6/2) uncoated sand grains; 40 percent woody and herbaceous fiber broken face, 5 percent rubbed; moderate fine subangular blocky structure; very friable; many fine and medium and few coarse roots; neutral; abrupt wavy boundary.

Bw1—6 to 10 inches; pale brown (10YR 6/3) sand; weak fine subangular blocky structure; very friable; few fine and medium roots; common medium faint light brownish gray (10YR 6/2) iron depletions in the matrix; common fine prominent yellowish brown (10YR 5/8) masses of iron accumulation in the matrix; about 3 percent fine gravel; slightly alkaline; clear wavy boundary.

Bw2—10 to 18 inches; yellowish brown (10YR 5/4) loamy sand; moderate medium subangular blocky structure; friable; common clay bridges between sand grains; common medium distinct light brownish gray (10YR 6/2) iron depletions in the matrix; many medium distinct yellowish brown (10YR 5/8) masses of iron accumulation in the matrix; about 3 percent fine gravel; slightly alkaline; abrupt wavy boundary.

2Cg—18 to 29 inches; 55 percent grayish brown (2.5Y 5/2) and 45 percent brown (7.5YR 5/4), stratified loam, very fine sandy loam, and sandy loam; massive; friable; common coarse prominent gray (5Y 6/1) iron depletions in the matrix; common medium prominent strong brown (7.5YR 5/8) masses of iron accumulation in the matrix; about 3 percent fine gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

2C1—29 to 41 inches; reddish brown (5YR 5/3), stratified silt loam and very fine sandy loam; massive; friable; common fine prominent gray (N 6/0) iron depletions in the matrix; common medium prominent yellowish brown (10YR 5/8) masses of iron accumulation in the matrix; about 3 percent fine gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

2C2—41 to 58 inches; reddish brown (5YR 5/3), stratified sandy loam and loamy sand; massive; very friable; common fine prominent gray (N 6/0) iron depletions in the matrix; about 2 percent fine gravel; strongly effervescent; moderately alkaline; clear wavy boundary.

2C3—58 to 80 inches; 70 percent reddish brown (5YR 5/3) silt and 30 percent light olive brown (2.5Y 5/4) very fine sandy loam; massive; friable; common fine prominent gray (N 6/0) iron depletions in the matrix; strongly effervescent; moderately alkaline.

The depth to loamy material and carbonates ranges from 18 to 26 inches. The content of gravel ranges from 0 to 3 percent throughout the profile.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 2 or 2.5 and chroma of 0 or 1.

The Bw horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. It is sand or loamy sand.

The 2Cg horizon has hue of 2.5Y, value of 5 or 6, and chroma of 1 or 2.

The 2C horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly stratified silt, silt loam, loam, very fine sandy loam, or sandy loam but has strata of loamy sand in some pedons. The thickness and sequence of the strata vary widely.

Cathro Series

The Cathro series consists of very poorly drained soils on moraines. These soils formed in organic material over loamy material. Permeability is moderately slow to moderately rapid in the organic material and moderately slow or moderate in the loamy material. Slope ranges from 0 to 2 percent.

Taxonomic classification: Loamy, mixed, euic, frigid Terric Haplosaprists

Typical pedon of Cathro muck, on a 1 percent west-facing slope in a forested area; at an elevation of 1,330 feet; 1,590 feet north and 590 feet east of the southwest corner of sec. 12, T. 30 N., R. 1 W.; central part of Charlton Township; USGS Hetherton Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 59 minutes 48.70 seconds N. and long. 84 degrees 24 minutes 52.22 seconds W., NAD 27:

Oa1—0 to 8 inches; dark brown (7.5YR 3/2) (broken face and rubbed) muck (sapric material); 40 percent woody and herbaceous fiber broken face, 5 percent rubbed; weak coarse granular structure; very friable; many fine and medium and common coarse roots; strongly acid; clear wavy boundary.

Oa2—8 to 22 inches; black (10YR 2/1) (broken face and pressed) muck (sapric material); 15 percent woody and herbaceous fiber broken face, 2 percent rubbed; weak medium subangular blocky structure parting to weak fine subangular blocky; very friable; common fine and medium and few coarse roots; 10 percent dark brown (7.5YR 3/4) woody fibers; very strongly acid; abrupt wavy boundary.

Cg1—22 to 27 inches; dark grayish brown (10YR 4/2) sandy loam; massive; friable; common medium prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; moderately acid; clear wavy boundary.

Cg2—27 to 38 inches; dark grayish brown (10YR 4/2) clay loam; massive; firm; common medium prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; slightly effervescent; moderately acid; gradual wavy boundary.

Cg3—38 to 60 inches; brown (7.5YR 4/2) clay loam; massive; firm; many medium prominent greenish gray (5GY 5/1) iron depletions in the matrix; strongly effervescent; slightly alkaline.

The thickness of the organic material ranges from 16 to 51 inches. It is typically 22 to 28 inches.

The Oa horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2.

Some pedons have a thin A horizon. This horizon has hue of 10YR and value and chroma of 2. It is sandy loam.

The Cg horizon has hue of 7.5YR to 5Y, value of 4 or 5, and chroma of 1 or 2. The content of gravel ranges from 0 to 14 percent, and the content of cobbles ranges from 0 to 5 percent.

Chinwhisker Series

The Chinwhisker series consists of moderately well drained soils on stream terraces and outwash plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 4 percent.

Taxonomic classification: Sandy, mixed, frigid Lamellic Haplorthods

Typical pedon of Chinwhisker sand, 0 to 4 percent slopes, on a 2 percent southwest-facing slope; at an elevation of 963 feet; 840 feet north and 1,090 feet west of the southeast corner of sec. 30, T. 32 N., R. 1 W.; east part of Corwith Township; USGS Hardwood Lake Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 07 minutes 45.96 seconds N. and long. 84 degrees 28 minutes 23.77 seconds W., NAD 27:

A—0 to 2 inches; black (N 2.5/0) sand, dark brown (7.5YR 3/2) dry; 40 percent intermixed light brownish gray (10YR 6/2) uncoated sand grains; moderate medium granular structure; very friable; common fine and few coarse roots; about 1 percent fine gravel; very strongly acid; clear smooth boundary.

E—2 to 11 inches; light brownish gray (10YR 6/2) sand, light gray (10YR 7/2) dry; weak medium subangular blocky structure; very friable; few fine and common medium and coarse roots; about 1 percent fine gravel; strongly acid; abrupt irregular boundary.

Bs1—11 to 18 inches; brown (7.5YR 4/4) sand; moderate medium subangular blocky structure; very friable; common medium and few fine and coarse roots; 25 percent moderately cemented dark brown (7.5YR 3/4) and strong brown (7.5YR 4/6) ortstein occurring as columns 3 to 7 inches wide and extending into the E´ horizon; about 1 percent fine gravel; very strongly acid; clear irregular boundary.

Bs2—18 to 23 inches; yellowish brown (10YR 5/6) sand; weak medium subangular blocky structure; very friable; few fine and common medium and coarse roots; 40 percent moderately cemented strong brown (7.5YR 5/6) ortstein occurring as columns 3 to 5 inches wide; moderately acid; clear irregular boundary.

E´—23 to 42 inches; light yellowish brown (10YR 6/4) sand, very pale brown (10YR 7/4) dry; single grain; loose; few medium and coarse roots; 17 percent moderately cemented strong brown (7.5YR 5/6) ortstein occurring as columns 2 to 5 inches wide; common medium distinct yellowish brown (10YR 5/6 and 5/8) masses of iron accumulation in the matrix, starting at a depth of 24 inches; moderately acid; clear wavy boundary.

E and Bt1—42 to 58 inches; light yellowish brown (10YR 6/4) sand, very pale brown (10YR 7/4) dry (E); single grain; loose; lamellae of dark yellowish brown (10YR 4/6) loamy sand and sandy loam (Bt) that are $^{1}/_{8}$ inch to 2 inches thick and have a total thickness of about $3^{1}/_{2}$ inches; moderate very

fine and medium subangular blocky structure; friable; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common medium distinct yellowish brown (10YR 5/8) and common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation in the matrix; slightly acid; clear wavy boundary.

E and Bt2—58 to 80 inches; light yellowish brown (10YR 6/4) sand, very pale brown (10YR 7/4) dry (E); single grain; loose; lamellae of yellowish brown (10YR 5/6) loamy sand and sand (Bt) that are $^{1}/_{16}$ to $^{1}/_{4}$ inch thick and have a total thickness of about 1 inch; weak very fine subangular blocky structure; very friable; clay bridging between sand grains; common medium distinct yellowish brown (10YR 5/8) masses of iron accumulation in the matrix; slightly acid.

The depth to redoximorphic features ranges from 24 to 29 inches. The content of gravel is 0 to 5 percent throughout the profile.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 2.

The Bs1 horizon has hue of 7.5YR, value of 3 to 5, and chroma of 3 or 4. Value and chroma of 3 do not occur together.

The Bs2 horizon has hue of 10YR, value of 4 or 5, and chroma of 6.

The E´ horizon and the E part of the E and Bt horizon have hue of 10YR, value of 5 or 6, and chroma of 4. Some pedons do not have an E´ horizon.

The Bt part of the E and Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 6.

Croswell Series

The Croswell series consists of moderately well drained soils on stream terraces and outwash plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 6 percent.

Taxonomic classification: Sandy, mixed, frigid Oxyaquic Haplorthods

Typical pedon of Croswell sand, 0 to 6 percent slopes, on a 2 percent southwest-facing slope in a forested area; at an elevation of 1,292 feet; 2,280 feet south and 1,340 feet west of the northeast corner of sec. 26, T. 29 N., R. 4 W.; south part of Hayes Township; USGS Frederic Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 52 minutes 23.56 seconds N. and long. 84 degrees 44 minutes 48.24 seconds W., NAD 27:

A—0 to 3 inches; black (10YR 2/1) sand, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; common fine and medium roots; very strongly acid; abrupt wavy boundary.

E—3 to 9 inches; grayish brown (10YR 5/2) sand, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; very friable; common fine and few medium roots; very strongly acid; clear wavy boundary.

Bs1—9 to 17 inches; brown (7.5YR 4/4) sand; weak very fine subangular blocky structure; very friable; common fine and medium and few coarse roots; 15 percent moderately cemented dark reddish brown (5YR 3/3) and strong brown (7.5YR 5/6) ortstein occurring as columns 3 to 5 inches wide and extending into the BC horizon; strongly acid; abrupt irregular boundary.

Bs2—17 to 27 inches; strong brown (7.5YR 4/6) sand; weak very fine subangular blocky structure; very friable; 24 percent moderately cemented dark reddish brown (5YR 3/3) and strong brown (7.5YR 5/6) ortstein occurring as columns 3 to 8 inches wide; moderately acid; clear wavy boundary.

BC—27 to 40 inches; brownish yellow (10YR 6/8) sand; weak very fine subangular blocky structure; very friable; 18 percent moderately cemented dark reddish brown (5YR 3/3) and strong brown (7.5YR 5/6) ortstein occurring as columns 2 to 5 inches wide; common medium distinct yellowish brown (10YR 5/8) masses of iron accumulation in the matrix, starting at a depth of 28 inches; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

C—40 to 80 inches; very pale brown (10YR 7/4) sand; single grain; loose; about 7 percent fine and medium gravel; moderately acid.

The content of gravel ranges from 0 to 10 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2. Reaction ranges from very strongly acid to slightly acid.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 or 2.

The Bs1 horizon has hue of 7.5YR, value of 3 to 5, and chroma of 4 to 6.

The Bs2 horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 4 to 6. The content of ortstein ranges from 0 to 24 percent. Reaction ranges from very strongly acid to moderately acid.

The BC horizon has hue of 5YR to 10YR, value of 5 or 6, and chroma of 3 to 8. The content of ortstein ranges from 0 to 18 percent.

The C horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 2 to 4. Reaction is moderately acid or slightly acid.

Dawson Series

The Dawson series consists of very poorly drained soils in closed depressions on outwash plains and moraines. These soils formed in moderately organic material over sandy material. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Slope ranges from 0 to 2 percent.

Taxonomic classification: Sandy or sandy-skeletal, mixed, dysic, frigid Terric Haplosaprists

Typical pedon of Dawson peat, in an area of Dawson-Loxley peats; on a 1 percent slope in a bog; at an elevation of 1,231 feet; 80 feet north and 1,750 feet west of the southeast corner of sec. 12, T. 29 N., R. 3 W.; Otsego Lake Township; USGS Turtle Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 54 minutes 53.89 seconds N. and long. 84 degrees 37 minutes 08.18 seconds W., NAD 27:

Oe—0 to 3 inches; dark reddish brown (5YR 3/2) (broken face) and dark reddish brown (5YR 2.5/2) (rubbed) peat (fibric material); 95 percent herbaceous fiber broken face, 75 percent rubbed; moderate fine granular structure; friable; many fine, common medium, and few coarse roots; extremely acid; abrupt wavy boundary.

Oa1—3 to 15 inches; dark reddish brown (5YR 3/2) (broken face) and dark reddish brown (5YR 2.5/2) (rubbed) muck (sapric material); 35 percent fiber broken face, 3 percent rubbed; moderate fine granular structure; very friable; common fine roots; primarily herbaceous material; extremely acid; abrupt smooth boundary.

Oa2—15 to 32 inches; dark reddish brown (5YR 2.5/2) (broken face) and black (5YR 2.5/1) (rubbed) muck (sapric material); 50 percent fiber broken face, 5 percent rubbed; weak thin platy structure; very friable; primarily herbaceous material; extremely acid; abrupt smooth boundary.

Cg—32 to 80 inches; dark grayish brown (2.5Y 4/2) sand; single grain; loose; extremely acid.

The depth to mineral material ranges from 16 to 51 inches.

The Cg horizon has hue of 10YR to 2.5Y, value of 3 or 4, and chroma of 1 to 3. It is sand, loamy sand, or the gravelly analogs of those textures. The content of gravel ranges from 0 to 35 percent. Reaction ranges from extremely acid to moderately acid.

Deford Series

The Deford series consists of very poorly drained soils on outwash plains and stream terraces. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 2 percent.

Taxonomic classification: Mixed, frigid Typic Psammaquents

Typical pedon of Deford muck, on a 1 percent west-facing slope in a wooded area; at an elevation of 1,219 feet; 590 feet south and 2,260 feet west of the northeast corner of sec. 15, T. 29 N., R. 2 W.; south part of Hayes Township; USGS Turtle Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 54 minutes 46.84 seconds N. and long. 84 degrees 32 minutes 06.73 seconds W., NAD 27:

Oa—0 to 5 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material); 20 percent woody and herbaceous fiber broken face, 3 percent rubbed; strong fine granular structure; very friable; many fine and medium and common coarse roots; extremely acid; abrupt wavy boundary.

Eg—5 to 9 inches; grayish brown (10YR 5/2) sand, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; very friable; few fine and medium roots; many medium distinct dark grayish brown (10YR 4/2) iron depletions in the matrix; many medium prominent yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; about 3 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

Bw1—9 to 15 inches; 60 percent dark yellowish brown (10YR 4/4) and 40 percent dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure; very friable; many medium prominent yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; about 3 percent fine and medium gravel; very strongly acid; abrupt irregular boundary.

Bw2—15 to 29 inches; dark yellowish brown (10YR 4/4) sand; weak medium subangular blocky structure; very friable; common medium prominent yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; about 3 percent fine and medium gravel; very strongly acid; clear wavy boundary.

Cg1—29 to 55 inches; grayish brown (10YR 5/2) sand; single grain; loose; common coarse faint dark

grayish brown (10YR 4/2) iron depletions in the matrix; about 5 percent fine and medium gravel; strongly acid; clear wavy boundary.

Cg2—55 to 60 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; common coarse distinct dark yellowish brown (10YR 4/6) masses of iron accumulation in the matrix; about 3 percent fine and medium gravel; moderately acid.

The content of gravel is 0 to 5 percent throughout the profile.

The Oa horizon has hue of 7.5YR or is neutral in hue. It has value of 2.5 and chroma of 0 to 1.

Some pedons have an A horizon. This horizon has hue of 10YR or is neutral in hue. It has value of 2 to 4 and chroma of 0 or 1. It is sand or mucky sand.

The Eg horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2.

The Bw horizon has hue of 10YR, value of 3 to 6, and chroma of 2 to 4.

The C horizon has hue of 10YR to 5Y, value of 4 to 7, and chroma of 2 to 4.

East Lake Series

The East Lake series consists of somewhat excessively drained soils on outwash plains and stream terraces. These soils formed in sandy and gravelly material. Permeability is rapid. Slope ranges from 0 to 35 percent.

Taxonomic classification: Sandy, mixed, frigid Entic Haplorthods

Typical pedon of East Lake sand, 0 to 6 percent slopes, on a 1 percent west-facing slope in a forested area; at an elevation of 1,258 feet; 2,260 feet north and 400 feet east of the southwest corner of sec. 9, T. 29 N., R. 2 W.; south part of Chester Township; USGS Turtle Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 55 minutes 14.12 seconds N. and long. 84 degrees 33 minutes 53.51 seconds W., NAD 27:

A—0 to 1 inch; very dark brown (10YR 2/2) sand, brown (7.5YR 4/2) dry; moderate fine granular structure; very friable; many fine and medium roots; about 1 percent fine and medium gravel; moderately acid; abrupt wavy boundary.

E—1 to 4 inches; brown (7.5YR 5/2) sand, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; very friable; many fine and medium roots; about 1 percent fine and medium gravel; moderately acid; clear wavy boundary.

Bs1—4 to 8 inches; brown (7.5YR 4/4) sand; weak fine subangular blocky structure; very friable; many fine and medium and few coarse roots; 10 percent strong brown (7.5YR 5/8 and 4/6) weakly cemented ortstein occurring as columns 2 to 5 inches wide and extending into the BC1 horizon; about 1 percent fine and medium gravel; moderately acid; gradual wavy boundary.

Bs2—8 to 18 inches; strong brown (7.5YR 5/6) sand; weak medium subangular blocky structure; very friable; few fine and medium roots; 10 percent strong brown (7.5YR 5/8 and 4/6) weakly cemented ortstein occurring as columns 2 to 5 inches wide; about 2 percent fine and medium gravel; slightly acid; gradual smooth boundary.

Bs3—18 to 21 inches; yellowish brown (10YR 5/6) sand; weak medium subangular blocky structure; very friable; 5 percent strong brown (7.5YR 4/6) weakly cemented ortstein occurring as columns 2 to 3 inches wide; about 2 percent fine and medium gravel; neutral; gradual smooth boundary.

BC1—21 to 31 inches; brownish yellow (10YR 6/6) sand; weak medium subangular blocky structure; very friable; about 2 percent fine and medium gravel; neutral; abrupt wavy boundary.

BC2—31 to 35 inches; yellowish brown (10YR 5/4) gravelly loamy coarse sand; weak medium subangular blocky structure; very friable; 30 percent fine and medium gravel; strongly effervescent; slightly alkaline; abrupt wavy boundary.

2C—35 to 80 inches; light yellowish brown (10YR 6/4), stratified very gravelly coarse sand and coarse sand; single grain; loose; 36 percent fine and medium gravel; strongly effervescent; slightly alkaline.

The depth to carbonates ranges from 24 to 40 inches. The content of gravel ranges from 0 to 20 percent in the upper part of the profile and from 12 to 55 percent in the substratum. The content of cobbles ranges from 0 to 7 percent throughout the profile.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2. Reaction ranges from moderately acid to neutral.

The E horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 or 3. It is sand or gravelly sand. Reaction ranges from moderately acid to neutral.

The Bs1 horizon has hue of 7.5YR, value of 4, and chroma of 3 or 4. The Bs2 and Bs3 horizons have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8. The Bs1, Bs2, and Bs3 horizons are sand or gravelly sand. They are moderately acid to neutral.

The BC horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is loamy coarse sand, loamy sand, sand, coarse sand, or the gravelly analogs of

those textures. Reaction ranges from moderately acid to neutral.

The 2C horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. It is stratified gravelly sand, very gravelly sand, coarse sand, or sand. Reaction is neutral or slightly alkaline.

Feldhauser Series

The Feldhauser series consists of moderately well drained soils on moraines. These soils formed in loamy material underlain by sandy material. Permeability is moderate in the loamy material and rapid in the sandy material. Slope ranges from 0 to 6 percent.

Taxonomic classification: Coarse-loamy, mixed, active, frigid Oxyaquic Glossudalfs

Typical pedon of Feldhauser fine sandy loam, 0 to 6 percent slopes, on a 2 percent south-facing slope on cropland; at an elevation of 1,396 feet; 1,265 feet south and 677 feet east of the northwest corner of sec. 34, T. 29 N., R. 3 W.; Otsego Lake Township; USGS Big Bradford Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 52 minutes 08.30 seconds N. and long. 84 degrees 39 minutes 44.96 seconds W., NAD 27:

Ap—0 to 10 inches; dark brown (10YR 3/3) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; very friable; common fine and medium roots; about 2 percent gravel; moderately acid; abrupt smooth boundary.

Bw—10 to 24 inches; dark yellowish brown (10YR 4/6) fine sandy loam; moderate medium subangular blocky structure; friable; common fine roots; about 3 percent gravel; moderately acid; clear wavy boundary.

E—24 to 32 inches; yellowish brown (10YR 5/4) fine sandy loam, very pale brown (10YR 7/3) dry; moderate medium subangular blocky structure; firm; strongly acid; gradual wavy boundary.

E/B—32 to 37 inches; 55 percent yellowish brown (10YR 5/4) fine sandy loam (E), very pale brown (10YR 7/3) dry; surrounding dark yellowish brown (10YR 4/6) sandy loam (Bt); moderate medium subangular blocky structure; friable; few faint discontinuous dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt—37 to 45 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium subangular blocky structure; friable; common faint discontinuous brown (10YR 4/4) clay films on faces of peds; few fine prominent strong brown (7.5YR 5/8) masses of iron accumulation in the matrix; about 3 percent gravel and 5 percent cobbles; moderately acid; abrupt wavy boundary.

2E and Bt—45 to 80 inches; brown (10YR 5/3) sand (E), very pale brown (10YR 7/4) dry; single grain; loose; lamellae of dark yellowish brown (10YR 4/6) loamy sand (Bt) $^1/_8$ inch to 2 inches thick; weak medium subangular blocky structure; very friable; common clay bridges between sand grains; neutral.

The lamellae extend to a depth of 30 to more than 80 inches. The content of gravel is 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 3. Reaction ranges from strongly acid to neutral. Some pedons have an A horizon.

The Bw horizon has hue of 10YR, value of 4, and chroma of 6. It is sandy loam or fine sandy loam.

The E horizon and the E part of the E/B horizon have hue of 10YR, value of 5 to 7, and chroma of 2 to 4. They are sandy loam or fine sandy loam. Reaction ranges from strongly acid to neutral.

The Bt horizon and the B part of the E/B horizon have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are loam or sandy loam. Reaction ranges from strongly acid to neutral.

The B part of the 2E and Bt horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 6. It is sandy loam or loamy sand. Reaction ranges from strongly acid to neutral.

Gladwin Series

The Gladwin series consists of somewhat poorly drained soils on stream terraces and outwash plains. These soils formed in sandy and gravelly material. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 3 percent.

Taxonomic classification: Sandy, mixed, frigid Argic Endoaquods

Typical pedon of Gladwin loamy sand, 0 to 3 percent slopes, on a 2 percent south-facing slope in a hayfield; at an elevation of 1,085 feet; 250 feet south and 750 feet west of the northeast corner of sec. 10, T. 31 N., R. 3 W.; Livingston Township; USGS Gaylord Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 5 minutes 53.73 seconds N. and long. 84 degrees 39 minutes 22.04 seconds W., NAD 27:

Ap—0 to 4 inches; very dark gray (10YR 3/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine and

medium roots; about 5 percent medium gravel; strongly acid; abrupt wavy boundary.

E—4 to 8 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; weak very fine subangular blocky structure; very friable; common fine and medium roots; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation in the lower part of the horizon; about 5 percent fine and medium gravel; strongly acid; abrupt wavy boundary.

Bs—8 to 12 inches; brown (7.5YR 4/3 and 4/4) sand; weak fine and very fine subangular blocky structure; very friable; common fine and medium roots; common fine distinct strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 10 percent fine and medium gravel; moderately acid; clear irregular boundary.

Bt—12 to 20 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; weak fine subangular blocky structure; very friable; few fine and medium roots; clay bridging between sand grains; common fine prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 20 percent fine and medium gravel; moderately acid; clear wavy boundary.

BC—20 to 25 inches; yellowish brown (10YR 5/4) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; few fine roots; common fine prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; common fine distinct pinkish gray (7.5YR 6/2) iron depletions in the matrix; about 5 percent fine and medium gravel; slightly acid; clear wavy boundary.

C—25 to 80 inches; grayish brown (10YR 5/2) and brown (10YR 5/3), stratified sand, gravelly sand, and very gravelly loamy sand; single grain; loose; common medium prominent strong brown (7.5YR 5/6) masses of iron accumulation in the matrix; common medium distinct dark gray (10YR 4/1) iron depletions in the matrix; about 45 percent fine and medium gravel; violently effervescent; moderately alkaline.

The depth to carbonates ranges from 20 to 35 inches. The content of gravel ranges from 0 to 20 percent in the upper part of the profile and from 10 to 45 percent in the substratum. The content of cobbles ranges from 0 to 5 percent throughout the profile.

The Ap horizon has hue of 10YR or 7.5YR, value of 2 to 3, and chroma of 1 or 2. Some pedons have an A horizon. This horizon is 1 to 4 inches thick. It has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The E horizon has hue of 10YR or 7.5YR and value of 5 or 6.

The Bs horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is gravelly loamy sand or gravelly sandy loam.

The BC horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4.

The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 2 to 4. It is stratified sand, gravelly sand, gravelly loamy sand, or very gravelly loamy sand.

Glossudalfs

Glossudalfs consist of well drained, moderately permeable soils on moraines. These soils formed in loamy and sandy material. Slope ranges from 0 to 30 percent.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3. It is dominantly sandy loam but in some pedons is loamy sand.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam or loamy sand.

The E part of the B/E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is sandy loam or loamy sand.

The Bt part of the B/E horizon and the Bt horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4. They are sandy clay loam, sandy loam, loam, or clay loam.

The C or 2C horizon has hue of 5YR, 7.5YR, or 10YR; value of 5 or 6; and chroma of 4 to 6. It is loamy sand, sandy loam, loam, sandy clay loam, or clay loam and commonly is stratified.

Graycalm Series

The Graycalm series consists of somewhat excessively drained soils on stream terraces and outwash plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 50 percent.

Taxonomic classification: Mixed, frigid Lamellic Udipsamments

Typical pedon of Graycalm sand, 0 to 6 percent slopes, on a 2 percent southwest-facing slope in a forested area; at an elevation of 1,297 feet; 52 feet north and 605 feet east of the southwest corner of sec. 33, T. 29 N., R. 1 W.; south part of Charlton Township; USGS Lovells Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 51 minutes 23.61 seconds N. and long. 84 degrees 26 minutes 58.25 seconds W., NAD 27:

A—0 to 1 inch; very dark gray (10YR 3/1) sand, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine granular; very friable; common fine and medium and few coarse roots; about 3 percent fine and medium gravel; very strongly acid; abrupt smooth boundary.

E—1 to 2 inches; grayish brown (10YR 5/2) sand, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; about 3 percent fine and medium gravel; very strongly acid; abrupt broken boundary.

Bw1—2 to 10 inches; brownish yellow (10YR 6/6) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; common fine and medium and few coarse roots; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bw2—10 to 19 inches; yellowish brown (10YR 5/6) sand; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; about 3 percent fine and medium gravel; very strongly acid; clear wavy boundary.

E and Bt—19 to 80 inches; yellowish brown (10YR 5/4) sand (E), light yellowish brown (10YR 6/4) dry; single grain; loose; starting at a depth of 25 inches, lamellae of strong brown (7.5YR 4/6) loamy sand (Bt) that are 1/8 to 1/2 inch thick and have a total thickness of less than 6 inches; weak very fine subangular blocky structure; very friable; few fine and medium roots; clay bridging between sand grains; about 7 percent gravel and 1 percent cobbles; strongly acid.

Depth to the first lamella ranges from 25 to 38 inches. The content of gravel ranges from 0 to 8 percent throughout the profile. The content of cobbles is 0 to 1 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 3, and chroma of 1 to 3.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6.

The E part of the E and Bt horizon has value of 5 to 7 and chroma of 4 to 6.

The Bt part of the E and Bt horizon has value of 5 or 6 and chroma of 4 to 6. It consists of lamellae that are 1/8 inch to 2 inches thick and have a total thickness of less than 6 inches.

Grayling Series

The Grayling series consists of excessively drained soils on outwash plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 45 percent.

Taxonomic classification: Mixed, frigid Typic Udipsamments

Typical pedon of Grayling sand, 0 to 6 percent slopes, on a 2 percent west-facing slope in a meadow; at an elevation of 1,169 feet; 1,605 feet south and 230 feet west of the northeast corner of sec. 33, T. 29 N., R. 1 W.; south part of Charlton Township; USGS Lovells Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 59 minutes 08.55 seconds N. and long. 84 degrees 29 minutes 57.93 seconds W., NAD 27:

A—0 to 3 inches; black (10YR 2/1) sand; weak medium granular structure; very friable; common fine roots; strongly acid; abrupt wavy boundary.

Bw1—3 to 6 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; common fine roots; very strongly acid; clear wavy boundary.

Bw2—6 to 14 inches; dark yellowish brown (10YR 4/6) sand; single grain; loose; few fine roots; very strongly acid; clear wavy boundary.

BC—14 to 27 inches; yellowish brown (10YR 5/4) sand; single grain; loose; few fine roots; about 1 percent fine and medium gravel; moderately acid; clear wavy boundary.

C—27 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; moderately acid.

The content of gravel is 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 or 1.

Some pedons have an E horizon, which has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6.

The BC horizon has hue of 10YR, value of 5, and chroma of 4 to 6.

The C horizon has hue of 10YR, value of 6, and chroma of 3 or 4.

Haplorthods

Haplorthods consist of moderately well drained to excessively drained, rapidly permeable soils on outwash plains. These soils formed in dominantly sandy material. Slope ranges from 0 to 45 percent.

The combined thickness of the surface layer and subsoil ranges from 20 to 50 inches. The texture is dominantly sand throughout the profile but in some pedons is loamy sand in the subsoil or coarse sand in the substratum. The content of rock fragments ranges from 0 to 15 percent.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 or 3.

The Bs1 horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. The Bs2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 3 to 6.

Hartwick Series

The Hartwick series consists of excessively drained soils in outwash channels and on outwash plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 6 percent.

Taxonomic classification: Sandy, mixed, frigid Entic Haplorthods

Typical pedon of Hartwick sand, 0 to 6 percent slopes, on a 2 percent west-facing slope in a pine plantation; at an elevation of 1,285 feet; 250 feet north and 1,000 feet west of the southeast corner of sec. 17, T. 29 N., R. 4 W.; south part of Hayes Township; USGS Lake Arrowhead Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 54 minutes 07.53 seconds N. and long. 84 degrees 48 minutes 44.66 seconds W., NAD 27:

A—0 to 2 inches; black (N 2.5/0) sand, very dark grayish brown (10YR 3/2) dry; 30 percent intermixed brown (7.5YR 5/2) uncoated sand grains; moderate fine subangular blocky structure; very friable; common fine and medium roots; very strongly acid; abrupt wavy boundary.

E—2 to 7 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 6/2) dry; weak fine and very fine subangular blocky structure; very friable; common fine and medium roots; about 3 percent fine gravel; strongly acid; abrupt wavy boundary.

Bs1—7 to 12 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; many fine and medium and common coarse roots; 15 percent moderately cemented dark brown (7.5YR 3/2) ortstein occurring as columns 2 to 8 inches wide and extending into the BC horizon; 8 percent fine and medium gravel; very strongly acid; clear irregular boundary.

Bs2—12 to 26 inches; strong brown (7.5YR 4/6) very gravelly sand; moderate medium subangular blocky structure parting to weak very fine subangular blocky; very friable; common fine and medium and few coarse roots; 13 percent moderately cemented dark brown (7.5YR 3/2) and strong brown (7.5YR 4/6) ortstein occurring as columns 2 to 8 inches wide; 36 percent fine and medium gravel; strongly acid; clear irregular boundary.

BC—26 to 38 inches; yellowish brown (10YR 5/6) gravelly sand; weak medium subangular blocky structure; very friable; few fine, medium, and coarse roots; 15 percent weakly cemented brown (7.5YR 4/4) and strong brown (7.5YR 4/6) ortstein occurring as columns 2 to 8 inches wide; 32 percent fine and medium gravel; moderately acid; clear wavy boundary.

C—38 to 80 inches; light yellowish brown (10YR 6/4) sand with thin strata of calcareous gravelly coarse sand 2 to 5 inches thick; single grain; loose; few medium and coarse roots; 5 percent fine and medium gravel; neutral.

The depth to calcareous strata ranges from 23 to more than 48 inches. The content of gravel ranges from 3 to 40 percent in individual horizons and averages less than 35 percent. The content of cobbles is 0 to 5 percent throughout the profile. Reaction ranges from very strongly acid to slightly acid in the upper part of the profile and is neutral or slightly alkaline in the substratum.

The A horizon has hue of 7.5YR or is neutral in hue. It has value of 2.5 or 3 and chroma of 0 to 2. Reaction ranges from very strongly acid to slightly acid.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. Value and chroma of 3 do not occur together. Reaction ranges from very strongly acid to moderately acid.

The Bs2 horizon has hue of 7.5YR, value of 4, and chroma of 4 to 6. Reaction ranges from very strongly acid to moderately acid.

The BC horizon has hue of 10YR, value of 5, and chroma of 6. Reaction is moderately acid or slightly acid.

The C horizon has hue of 10YR, value of 6, and chroma of 4. It is dominantly noncalcareous sand with thin strata of gravelly sand, very gravelly sand, or gravelly coarse sand. Some gravelly strata are violently effervescent. Reaction is neutral or slightly alkaline.

Histosols

Histosols consist of very poorly drained, moderately slowly permeable to moderately rapidly permeable soils on outwash plains and moraines. These soils formed in organic material. Slope is 0 to 1 percent.

The thickness of the organic material ranges from 16 to more than 50 inches. The surface tier is dominantly muck or mucky peat but in some pedons is peat. The subsurface tiers are dominantly muck but in

some pedons are mucky peat. The organic material typically has hue of 5YR, 7.5YR, 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. The mineral substratum ranges from sand to clay. It has hue of 5YR to 5Y, value of 5 or 6, and chroma of 1 to 3.

Islandlake Series

The Islandlake series consists of somewhat excessively drained soils on moraines, stream terraces, and outwash plains. These soils formed in thick deposits of sandy material (fig. 19). Permeability is rapid. Slope ranges from 0 to 18 percent.

Taxonomic classification: Sandy, mixed, frigid Lamellic Haplorthods

Figure 19.—Typical profile of an Islandlake sand. Depth is marked in inches.

Typical pedon of Islandlake loamy sand, 0 to 6 percent slopes, on a 2 percent southeast-facing slope in a forested area; at an elevation of 1,392 feet; 2,095 feet south and 50 feet west of the northeast corner of sec. 8, T. 30 N., R. 4 W.; north part of Hayes Township; USGS Elmira Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 00 minutes 43.22 seconds N. and long. 84 degrees 48 minutes 35.48 seconds W., NAD 27:

A—0 to 2 inches; very dark gray (N 3/0) loamy sand, dark grayish brown (10YR 4/2) dry; 30 percent intermixed brown (7.5YR 5/2) uncoated sand grains; weak coarse granular structure; very friable; many fine and medium and few coarse roots; about 2 percent fine and medium gravel; very strongly acid; abrupt smooth boundary.

E—2 to 7 inches; brown (7.5YR 5/2) loamy sand, pinkish gray (7.5YR 6/2) dry; weak medium subangular blocky structure; very friable; many fine and medium and few coarse roots; about 2 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

Bhs—7 to 12 inches; dark brown (7.5YR 3/2) loamy sand; weak medium subangular blocky structure; friable; common fine and medium and few coarse roots; 15 percent strong brown (7.5YR 4/6) weakly cemented ortstein occurring as columns 2 to 5 inches wide and extending into the Bs2 horizon; about 2 percent fine and medium gravel; very strongly acid; abrupt irregular boundary.

Bs1—12 to 17 inches; brown (7.5YR 4/4) sand; weak medium and coarse subangular blocky structure; very friable; 22 percent strong brown (7.5YR 4/6) weakly cemented ortstein occurring as columns 3 to 5 inches wide; about 5 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bs2—17 to 28 inches; strong brown (7.5YR 5/6) sand; weak medium subangular blocky structure; very friable; 13 percent strong brown (7.5YR 4/6) weakly cemented ortstein occurring as columns 2 to 4 inches wide; about 5 percent fine and medium gravel; strongly acid; clear wavy boundary.

E and Bt—28 to 60 inches; brown (7.5YR 5/4) sand (E), pinkish gray (7.5YR 6/2) dry; weak medium subangular blocky structure parting to single grain; very friable and loose; lamellae of strong brown (7.5YR 4/6) sand and loamy sand (Bt) that are 1/8 to 1 inch thick and have a total thickness of about 3 inches; moderate fine and very fine subangular blocky structure; very friable; clay bridging between sand grains; about 8 percent fine and medium gravel; moderately acid; clear wavy boundary.

C—60 to 80 inches; reddish yellow (7.5YR 6/6) sand; single grain; loose; about 5 percent fine and medium gravel; moderately acid.

The depth to lamellae ranges from 28 to 43 inches. The content of gravel is 0 to 5 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2. It is sand or loamy sand. Reaction is very strongly acid.

The E horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 1 or 2. Reaction is very strongly acid.

The Bhs horizon has hue of 7.5YR or 5YR, value of 3, and chroma of 2.

The Bs horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 4 to 6.

The E part of the E and Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4.

The Bt part of the E and Bt horizon has hue of 7.5YR, value of 4, and chroma of 4 to 6. It occurs as lamellae 1/8 to 1 inch thick.

The C horizon has hue of 10YR or 7.5YR and value and chroma of 6.

Kalkaska Series

The Kalkaska series consists of somewhat excessively drained soils on moraines and outwash plains. These soils formed in thick deposits of sandy material (fig. 20). Permeability is rapid. Slope ranges from 0 to 50 percent.

Taxonomic classification: Sandy, mixed, frigid Typic Haplorthods

Typical pedon of Kalkaska sand, 8 to 50 percent slopes, dissected, on a 26 percent northeast-facing slope in a forested area; at an elevation of 1,453 feet; 850 feet south and 1,675 feet west of the northeast corner of sec. 34, T. 29 N., R. 4 W.; south part of Hayes Township; USGS Frederic Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 52 minutes 12.53 seconds N. and long. 84 degrees 46 minutes 27.69 seconds W., NAD 27:

Oe—0 to 1 inch; black (N 2.5/0), partially decomposed forest litter; very strongly acid; abrupt wavy boundary.

A—1 to 3 inches; black (N 2.5/0) sand, black (10YR 2/1) dry; about 30 percent intermixed pinkish gray (7.5YR 6/2) uncoated sand grains; moderate fine subangular blocky structure; friable; many fine and common medium and coarse roots; about 7 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

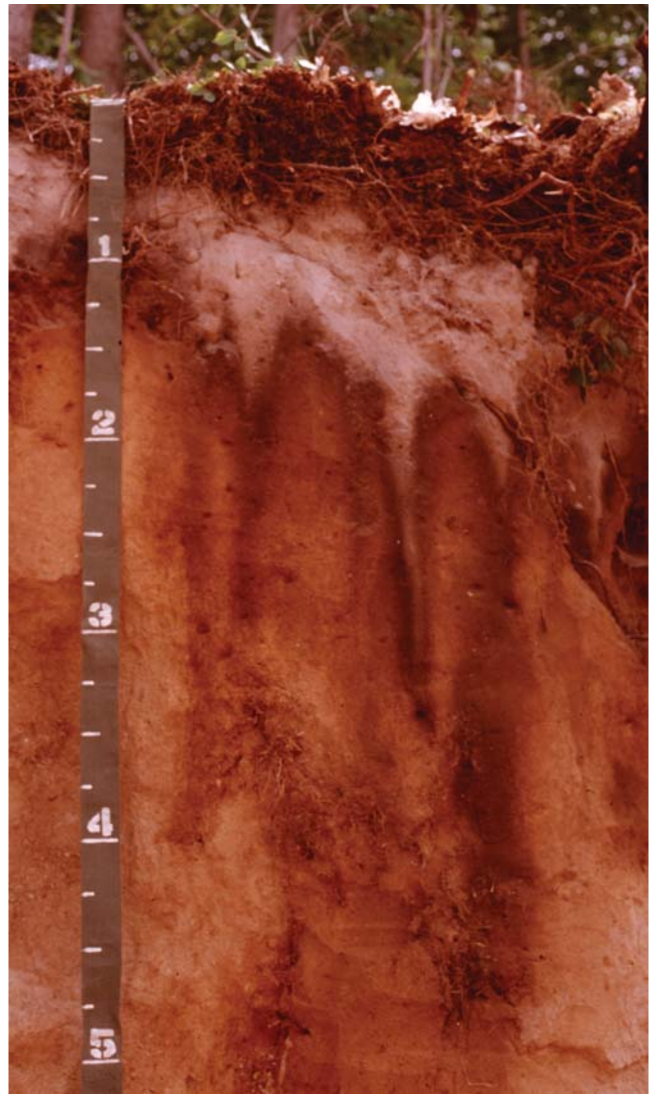

Figure 20.—Typical profile of a Kalkaska sand. Depth is marked in feet.

E—3 to 9 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure parting to single grain; very friable and loose; many fine and common medium and coarse roots; about 7 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

Bhs—9 to 12 inches; dark reddish brown (5YR 3/2) sand; moderate fine subangular blocky structure; friable; many fine and common medium and coarse roots; about 9 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

Bs1—12 to 18 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure parting to weak fine subangular blocky; very friable; common

fine, medium, and coarse roots; 21 percent moderately cemented dark reddish brown (5YR 3/2) ortstein occurring as columns 2 to 4 inches wide and extending into the BC horizon; about 9 percent fine and medium gravel; very strongly acid; clear irregular boundary.

Bs2—18 to 28 inches; strong brown (7.5YR 4/6) sand; weak medium subangular blocky structure parting to weak fine subangular blocky; very friable; 45 percent moderately cemented dark reddish brown (5YR 3/2) ortstein occurring as columns 1 to 3 inches wide; about 4 percent fine and medium gravel; strongly acid; clear wavy boundary.

BC—28 to 41 inches; yellowish brown (10YR 5/6) sand; weak medium subangular blocky structure parting to single grain; very friable and loose; few medium and coarse roots; 41 percent moderately cemented dark reddish brown (5YR 3/2) ortstein occurring as columns 1 to 3 inches wide; about 4 percent fine and medium gravel; moderately acid; gradual wavy boundary.

C—41 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; about 5 percent fine and medium gravel; moderately acid.

The content of gravel is 0 to 10 percent throughout the profile. Reaction ranges from extremely acid to moderately acid throughout the profile. The content of ortstein in the Bhs, Bs, and BC horizons ranges from 0 to 45 percent.

The A horizon has hue of 5YR to 10YR, value of 2 to 3, and chroma of 1 to 3. Some pedons have an Ap horizon, which has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 or 2.

The Bhs horizon has hue of 5YR or 7.5YR, value of 2.5 or 3, and chroma of 2 or 3.

The Bs horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 4 to 6.

The BC horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6.

The C horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 to 6.

Kellogg Series

The Kellogg series consists of moderately well drained soils on lake plains. These soils formed in 20 to 40 inches of sandy material and in the underlying clayey material (fig. 21). Permeability is rapid in the sandy material and slow or very slow in the clayey material. Slope ranges from 0 to 6 percent.

Figure 21.—Typical profile of a Kellogg sand. Depth is marked in feet.

Taxonomic classification: Sandy over clayey, mixed, active, frigid Alfic Oxyaquic Haplorthods

Typical pedon of Kellogg sand, 0 to 6 percent slopes, on a 3 percent south-facing slope in a forested area; at an elevation of 1,084 feet; 2,680 feet north and 335 feet east of the southwest corner of sec. 35, T. 32 N., R. 3 W.; east part of Corwith Township; USGS Gaylord Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 07 minutes 14.67 seconds N. and long. 84 degrees 39 minutes 05.29 seconds W., NAD 27:

A—0 to 3 inches; black (10YR 2/1) loamy sand, very dark gray (10YR 3/1) dry; intermixed with 30 percent pinkish gray (7.5YR 6/2) uncoated sand grains; weak medium granular structure; very friable; many fine and medium and common coarse roots; about 2 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

E—3 to 11 inches; pinkish gray (7.5YR 6/2) sand, pinkish gray (7.5YR 7/2) dry; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; common fine, medium, and coarse roots; about 2 percent fine and medium gravel; strongly acid; abrupt wavy boundary.

Bs1—11 to 17 inches; dark reddish brown (5YR 3/4) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; common fine and medium and few coarse roots; about 2 percent fine and medium gravel; strongly acid; clear irregular boundary.

Bs2—17 to 31 inches; strong brown (7.5YR 4/6) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; few fine and coarse and common medium roots; about 2 percent fine and medium gravel; moderately acid; clear wavy boundary.

Bs3—31 to 33 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; few medium and coarse roots; about 10 percent fine and medium gravel; slightly acid; abrupt wavy boundary.

2B/E—33 to 36 inches; 70 percent reddish brown (5YR 4/4) silty clay (Bt); strong coarse angular blocky structure; very firm; few fine and very fine tubular pores; common faint dark reddish brown (5YR 3/4) clay films on faces of peds and in root channels; Bt material surrounded by brown (7.5YR 5/2) loamy sand (E), pinkish gray (7.5YR 6/2) dry; moderate fine and medium subangular blocky structure; friable; common fine and very fine tubular pores; few medium and coarse roots; few fine distinct yellowish red (5YR 4/6) masses of iron accumulation in the matrix; neutral; clear wavy boundary.

2Bt—36 to 43 inches; reddish brown (5YR 4/4) silty clay; strong medium prismatic structure parting to moderate medium angular blocky; very firm; few fine and very fine tubular pores; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; few distinct dark reddish brown (5YR 3/2) organic coatings on faces of peds and in root channels; slightly alkaline; clear wavy boundary.

2BC—43 to 52 inches; reddish brown (5YR 5/4) silty clay; strong medium subangular blocky structure; firm; few medium and coarse roots; common distinct yellowish red (5YR 4/6) clay films on faces of peds; strongly effervescent; slightly alkaline; gradual wavy boundary.

2C—52 to 80 inches; brown (7.5YR 5/4) and light brown (7.5YR 6/4) silty clay; weak thick platy structure derived from deposition; firm; violently effervescent; moderately alkaline.

The thickness of the sandy material ranges from 26 to 35 inches. The content of gravel ranges from 2 to 10 percent in the sandy material and from 0 to 2 percent in the underlying clayey material. Reaction ranges from very strongly acid to slightly acid in the sandy material and from moderately acid to moderately alkaline in the clayey material. The depth to redoximorphic features ranges from 30 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 3, and chroma of 1 to 3. Some pedons have an Ap horizon, which has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3.

The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2. It is sand or loamy sand.

The Bs1 horizon has hue of 5YR or 7.5YR and value and chroma of 3 or 4. It is sand or loamy sand.

The Bs2 horizon has hue of 7.5YR, value of 4 or 5, and chroma of 5 or 6. It is sand or loamy sand.

The E part of the 2E/B or 2B/E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 3. It is loamy sand or sandy loam.

The 2Bt horizon and the Bt part of the 2E/B or 2B/E horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 5. They are clay, silty clay, or silty clay loam.

Some pedons do not have a 2BC horizon.

The 2C horizon has hue of 5YR or 7.5YR. It is clay, silty clay, or silty clay loam.

Kent Series

The Kent series consists of moderately well drained soils on moraines. These soils formed in thick deposits of loamy and clayey material. Permeability is slow. Slope ranges from 2 to 12 percent.

Taxonomic classification: Fine, mixed, semiactive, frigid Oxyaquic Glossudalfs

Typical pedon of Kent sandy loam, 6 to 12 percent slopes, on a 8 percent northeast-facing slope in a pasture; at an elevation of 1,409 feet; 200 feet south and 450 feet west of the northeast corner of sec. 10, T. 30 N., R. 1 W.; north part of Charlton Township; USGS Johannesburg Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 00 minutes 45.45 seconds N. and long. 84 degrees 23 minutes 16.69 seconds W., NAD 27:

Ap—0 to 6 inches; dark gray (10YR 4/1) sandy loam, gray (10YR 5/1) dry; moderate medium granular structure; very friable; common fine and few medium roots; few fine and very fine tubular pores;

common medium faint rounded black (10YR 2/1) worm casts; neutral; abrupt smooth boundary.

B/E—6 to 13 inches; 55 percent brown (7.5YR 4/4) clay (Bt); moderate medium angular blocky structure; firm; few fine and very fine tubular pores; Bt material surrounding grayish brown (10YR 5/2) loam (E), pinkish gray (7.5YR 7/2) dry, along worm and root channels and as clay depletions on faces of peds; common fine and very fine tubular pores; common fine and few coarse roots; common medium prominent rounded black (10YR 2/1) worm casts; common prominent discontinuous brown (7.5YR 4/2) clay films on faces of peds and in pores; about 1 percent gravel; slightly acid; clear wavy boundary.

Bt—13 to 22 inches; brown (7.5YR 5/4) clay; moderate medium angular blocky structure; very firm; few fine and very fine tubular pores; common medium prominent black (10YR 2/1) rounded worm casts; common prominent discontinuous brown (7.5YR 4/2) clay films on faces of peds and in pores; common prominent discontinuous grayish brown (10YR 5/2) clay depletions on horizontal faces of peds; neutral; gradual wavy boundary.

C1—22 to 28 inches; light brown (7.5YR 6/4) silty clay; moderate thin platy structure derived from deposition; very firm; slightly effervescent; moderately alkaline; gradual wavy boundary.

C2—28 to 60 inches; light brown (7.5YR 6/4) silty clay; strong thin platy structure derived from deposition; very firm; few medium prominent brownish yellow (10YR 6/8) masses of iron accumulation in the matrix; slightly effervescent; moderately alkaline.

The depth to carbonates ranges from 22 to 30 inches. The content of gravel and cobbles is 0 to 5 percent throughout the profile. Reaction ranges from moderately acid to neutral in the upper part of the profile and is slightly alkaline or moderately alkaline in the substratum.

The Ap horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 4 and chroma of 0 to 2. Some pedons have an A horizon.

Some pedons have E and E/B horizons. The E horizon and the E part of the E/B or B/E horizon are sandy loam or loam.

The Bt horizon and the B part of the E/B or B/E horizon have hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. They are clay.

The C horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 4. It is clay or silty clay.

Kinross Series

The Kinross series consists of poorly drained soils on outwash plains and lake plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 2 percent.

Taxonomic classification: Sandy, mixed, frigid Typic Endoaquods

Typical pedon of Kinross muck, in an area of Kinross-Au Gres complex, 0 to 3 percent slopes; in a nearly level forested area; at an elevation of 1,140 feet; 100 feet south and 2,030 feet west of the northeast corner of sec. 5, T. 26 N., R. 4 W.; Grayling Township, Crawford County; USGS Lake Margrethe Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 41 minutes 05.24 seconds N. and long. 84 degrees 49 minutes 00.76 second W., NAD 27:

Oa—0 to 3 inches; black (10YR 2/1) (broken face and rubbed) muck (sapric material); about 80 percent fiber, 15 percent rubbed; weak medium granular structure; very friable; many fine, medium, and coarse roots; extremely acid; abrupt smooth boundary.

E—3 to 10 inches; grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry; very weak very fine subangular blocky structure; very friable; common fine and medium roots; common medium faint dark grayish brown (10YR 4/2) iron depletions in the matrix; strongly acid; abrupt irregular boundary.

Bhs—10 to 14 inches; dark reddish brown (5YR 3/2) sand; moderate medium subangular blocky structure; friable; common fine and medium roots; about 40 percent strongly cemented ortstein in horizontal planes and vertical columns extending into the Bs horizon and surrounding columns of grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry (E material); very strongly acid; clear wavy boundary.

Bs—14 to 22 inches; yellowish brown (10YR 5/6) sand; weak fine subangular blocky structure; very friable; common fine roots; common medium distinct pale brown (10YR 6/3) iron depletions in the matrix; about 20 percent strongly cemented dark reddish brown (5YR 3/2) ortstein occurring as columns surrounding grayish brown (10YR 5/2) sand, light gray (10YR 7/2) dry (E material); strongly acid; clear wavy boundary.

C—22 to 80 inches; yellowish brown (10YR 5/4) sand; single grain; loose; common fine prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; moderately acid.

The texture is sand in all mineral horizons. The content of ortstein ranges from 10 to 45 percent in the Bhs and Bs horizons.

The Oa horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 1 or 2.

The Bhs horizon has hue of 5YR or 7.5YR and value and chroma of 2 or 3.

The Bs horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6.

Some pedons have a BC horizon, which has hue of 10YR, value of 4 or 5, and chroma of 4 to 6.

The C horizon has value of 5 or 6 and chroma of 2 to 4.

Leafriver Series

The Leafriver series consists of very poorly drained soils in depressions on stream terraces and outwash plains. These soils formed in a thin layer of organic material and in the underlying sandy material. Permeability is moderate or moderately rapid in the organic material and rapid in the sandy substratum. Slope is 0 to 1 percent.

Taxonomic classification: Sandy, mixed, frigid Histic Humaquepts

Typical pedon of Leafriver muck, in an area of Tawas-Leafriver mucks; on a 1 percent south-facing slope in a forested area; at an elevation of 1,231 feet; 100 feet south and 1,800 feet east of the northwest corner of sec. 14, T. 29 N., R. 2 W.; south part of Chester Township; USGS Johannesburg Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 54 minutes 51.14 seconds N. and long. 84 degrees 30 minutes 40.97 seconds W., NAD 27:

Oa—0 to 9 inches; black (N 2.5/0) muck (sapric material); 20 percent fiber broken face, 3 percent rubbed; moderate fine subangular blocky structure; friable; many fine and medium and common coarse roots; moderately acid; abrupt wavy boundary.

A—9 to 11 inches; very dark gray (10YR 3/1) mucky sand, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; friable; few fine, medium, and coarse roots; about 3 percent fine and medium gravel; moderately acid; abrupt wavy boundary.

Cg1—11 to 15 inches; dark grayish brown (10YR 4/2) sand; single grain; loose; common medium prominent dark gray (5YR 4/1) iron depletions in the matrix; about 3 percent fine and medium gravel; moderately acid; clear wavy boundary.

Cg2—15 to 80 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; few medium distinct grayish brown (10YR 5/2) iron depletions in the matrix; about 3 percent fine and medium gravel; neutral.

The thickness of the organic material ranges from 9 to less than 16 inches. The content of gravel is 0 to 3 percent in the sandy material.

The O horizon has hue of 7.5YR or is neutral in hue. Reaction is strongly acid or moderately acid.

The A horizon is moderately acid or slightly acid.

The Cg horizon has hue of 10YR or 2.5Y and value of 4 or 5. Reaction ranges from moderately acid to neutral.

Leelanau Series

The Leelanau series consists of well drained soils on moraines. These soils formed in thick deposits of sandy material. Permeability is moderately rapid. Slope ranges from 0 to 50 percent.

Taxonomic classification: Sandy, mixed, frigid Alfic Haplorthods

Typical pedon of Leelanau loamy sand, 0 to 6 percent slopes, on a 5 percent southwest-facing slope in a forested area; at an elevation of 1,098 feet; 1,900 feet south and 1,950 feet west of the northeast corner of sec. 3, T. 32 N., R. 3 W.; west part of Corwith Township; USGS Vanderbilt Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 11 minutes 45.00 seconds N. and long. 84 degrees 39 minutes 35.04 seconds W., NAD 27:

A—0 to 2 inches; black (10YR 2/1) loamy sand, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; common fine and few medium roots; neutral; abrupt wavy boundary.

E—2 to 7 inches; light brownish gray (10YR 6/2) sand, pale brown (10YR 6/3) dry; weak very fine subangular blocky structure; very friable; common fine roots; slightly acid; abrupt wavy boundary.

Bhs—7 to 12 inches; dark brown (7.5YR 3/2) sand; moderate medium subangular blocky structure; friable; common fine and medium roots; slightly acid; clear irregular boundary.

Bs1—12 to 16 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure; friable; common fine and few medium and coarse roots; moderate acid; clear wavy boundary.

Bs2—16 to 21 inches; dark yellowish brown (10YR 4/6) sand; weak medium subangular blocky structure; friable; few fine roots; 20 percent

strongly cemented ortstein occurring as columns 1 to 2 inches wide; about 7 percent gravel and 2 percent cobbles; strongly acid; abrupt wavy boundary.

E/B—21 to 37 inches; 70 percent yellowish brown (10YR 5/4) sand (E), pale brown (10YR 6/3) dry; single grain; loose; E material surrounding brown (7.5YR 4/4) sandy loam (Bt); weak coarse subangular blocky structure; friable; many distinct clay bridges between sand grains; about 3 percent gravel; neutral; abrupt wavy boundary.

Bt—37 to 52 inches; brown (7.5YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; many distinct clay bridges between sand grains; about 3 percent gravel; neutral; abrupt wavy boundary.

C—52 to 80 inches; brown (7.5YR 5/4) loamy sand; single grain; loose; about 3 percent gravel; strongly effervescent; moderately alkaline.

The depth to carbonates ranges from 36 to 52 inches. The content of gravel ranges from 0 to 10 percent and the content of cobbles from 0 to 5 percent throughout the profile. Reaction ranges from strongly acid to neutral in the upper part of the profile and from neutral to moderately alkaline in the substratum.

Some pedons have an Oe horizon. This horizon is made up of partially decomposed leaves. It has hue of 7.5YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2.

The A horizon has hue of 7.5YR or 10YR, value of 2 to 3, and chroma of 1.

The E horizon has hue of 7.5YR or 10YR and value of 5 or 6. It is sand or loamy sand.

The Bhs horizon has hue of 7.5YR or 5YR and value and chroma of 2 to 3. It is sand or loamy sand. Some pedons do not have a Bhs horizon.

The Bs1 horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 4 or 5. It is sand or loamy sand.

The Bs2 horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is sand or loamy sand.

Some pedons have an E´ horizon. The E´ horizon and the E part of the E/B horizon have hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 2 to 4. They are sand or loamy sand.

The Bt horizon and the B part of the E/B horizon have hue of 7.5YR or 5YR and chroma of 4 to 6. They are loam or sandy loam.

The C horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 or 4.

Lindquist Series

The Lindquist series consists of somewhat excessively drained soils on outwash plains, stream terraces, and moraines. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 50 percent.

Taxonomic classification: Sandy, mixed, frigid Lamellic Haplorthods

Typical pedon of Lindquist sand, 0 to 6 percent slopes, on a 1 percent south-facing slope in a forested area; at an elevation of 1,287 feet; 405 feet south and 2,600 feet east of the northwest corner of sec. 34, T. 30 N., R. 2 W.; north part of Chester Township; USGS Turtle Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 57 minutes 19.26 seconds N. and long. 84 degrees 32 minutes 15.03 seconds W., NAD 27:

A—0 to 1 inch; black (5YR 2.5/1) sand, dark reddish brown (5YR 3/2) dry; weak medium granular structure; very friable; many fine and medium and few coarse roots; about 3 percent fine and medium gravel; very strongly acid; abrupt smooth boundary.

E—1 to 3 inches; pinkish gray (7.5YR 6/2) sand, pinkish gray (7.5YR 7/2) dry; weak very fine subangular blocky structure; very friable; many fine and medium and few coarse roots; about 3 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

Bs1—3 to 10 inches; dark brown (7.5YR 3/4) sand; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; small pockets of dark brown (7.5YR 3/2) Bhs material; 18 percent weakly cemented dark brown (7.5YR 3/2) ortstein occurring as columns 2 to 3 inches wide and extending into the Bs2 horizon; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bs2—10 to 21 inches; strong brown (7.5YR 5/6) sand; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; 10 percent weakly cemented dark brown (7.5YR 3/2) ortstein occurring as columns 2 to 3 inches wide; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bs3—21 to 28 inches; reddish yellow (7.5YR 6/6) sand; weak medium subangular blocky structure; very friable; about 8 percent fine and medium gravel; strongly acid; clear wavy boundary.

E and Bt—28 to 80 inches; light brown (7.5YR 6/4) sand (E), pinkish gray (7.5YR 7/2) dry; weak very fine subangular blocky structure; very friable; starting at a depth of 39 inches, lamellae of brown (7.5YR 4/4) sand and loamy sand (Bt) that are $^1/_{16}$ to $^1/_2$ inch thick and have a total thickness of about 2 inches; weak very fine and fine subangular blocky structure; very friable; few fine and medium roots in the upper 15 inches; clay bridging between sand grains in the lamellae; about 8 percent fine and medium gravel; slightly acid.

The content of gravel ranges from 0 to 14 percent and the content of cobbles from 0 to 5 percent throughout the profile. Some pedons have thin strata of gravelly sand. The content of ortstein ranges from 0 to 30 percent in the Bs horizon. Depth to the first lamella ranges from 36 to 43 inches.

The A horizon has hue of 10YR to 5YR or is neutral in hue. It has value of 2 to 4 and chroma of 0 to 2.

The E horizon has hue of 10YR or 7.5YR and value of 5 or 6.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. Value and chroma of 3 do not occur together.

The Bs2 and Bs3 horizons have hue of 10YR or 7.5YR and value and chroma of 4 to 6.

The E part of the E and Bt horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 3 or 4.

The Bt part of the E and Bt horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is sand or loamy sand.

Loxley Series

The Loxley series consists of very poorly drained soils in closed depressions on outwash plains and moraines. These soils formed in herbaceous organic deposits more than 51 inches thick. Permeability is moderately slow to moderately rapid. Slope ranges from 0 to 2 percent.

Taxonomic classification: Dysic, frigid Typic Haplosaprists

Typical pedon of Loxley peat, in an area of Dawson-Loxley peats; in a nearly level blueberry bog; at an elevation of 1,244 feet; 40 feet north and 1,800 feet east of the southwest corner of sec. 12, T. 29 N., R. 3 W.; Otsego Lake Township; USGS Otsego Lake Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 54 minutes 53.67 seconds N. and long. 84 degrees 37 minutes 07.65 seconds W., NAD 27:

Oi—0 to 3 inches; dark reddish brown (5YR 3/2) (broken face) and dark reddish brown (5YR 2.5/2) (rubbed) peat (fibric material); 95 percent herbaceous fiber broken face, 75 percent rubbed; weak thin platy structure; very friable; common fine and medium roots; extremely acid; abrupt smooth boundary.

Oa1—3 to 17 inches; dark reddish brown (5YR 3/2) (broken face) and dark reddish brown (5YR 2.5/2) (rubbed) muck (sapric material); 65 percent fiber broken face, 15 percent rubbed; moderate fine granular structure; very friable; few fine roots; primarily herbaceous material; extremely acid; abrupt smooth boundary.

Oa2—17 to 24 inches; dark reddish brown (5YR 2.5/2) (broken face) and black (5YR 2.5/1) (rubbed) muck (sapric material); 40 percent fiber broken face, 3 percent rubbed; weak thin platy structure; very friable; primarily herbaceous material; extremely acid; abrupt smooth boundary.

Oa3—24 to 39 inches; dark reddish brown (5YR 3/4) (broken face) and dark reddish brown (5YR 3/2) (rubbed) muck (sapric material); 50 percent fiber broken face, 3 percent rubbed; 3 percent woody fibers; weak thin platy structure; very friable; primarily herbaceous material; extremely acid; abrupt smooth boundary.

Oa4—39 to 54 inches; dark reddish brown (5YR 3/3) (broken face) and dark reddish brown (5YR 3/2) (rubbed) muck (sapric material); $^1/_4$-inch-thick black (N 2.5/0) layers throughout the horizon; 50 percent fiber broken face, 5 percent rubbed; weak medium platy structure; very friable; primarily herbaceous material; extremely acid; abrupt smooth boundary.

Oa5—54 to 64 inches; dark reddish brown (5YR 3/2) (broken face) and dark reddish brown (5YR 2.5/2) (rubbed) muck (sapric material); 50 percent fiber broken face, 5 percent rubbed; weak medium platy structure; very friable; primarily herbaceous material; extremely acid; abrupt smooth boundary.

Oa6—64 to 80 inches; dark reddish brown (5YR 3/2) (broken face) and dark reddish brown (5YR 2.5/2) (rubbed) muck (sapric material); 80 percent fiber broken face, 15 percent rubbed; weak medium platy structure; very friable; primarily herbaceous material; very strongly acid.

The organic material is more than 51 inches thick. In some pedons the surface is covered with sphagnum moss.

Lupton Series

The Lupton series consists of very poorly drained soils in depressions on outwash plains and moraines. These soils formed in herbaceous organic deposits

more than 51 inches thick. Permeability is moderately slow to moderately rapid. Slope ranges from 0 to 2 percent.

Taxonomic classification: Euic, frigid Typic Haplosaprists

Typical pedon of Lupton muck, in an area of Tawas-Lupton mucks; on a 1 percent northwest-facing slope in a forested area; at an elevation of 969 feet; 3,944 feet north and 75 feet west of the southeast corner of sec. 26, T. 32 N., R. 1 W.; east part of Corwith Township; USGS Hardwood Lake 7.5-minute topographic quadrangle; lat. 45 degrees 08 minutes 14.80 seconds N. and long. 84 degrees 24 minutes 28.45 seconds W., NAD 27:

Oa1—0 to 13 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material); 5 percent fiber broken face, less than 1 percent rubbed; weak fine granular structure; very friable; neutral; clear smooth boundary.

Oa2—13 to 20 inches; black (10YR 2/1) (broken face and rubbed) muck (sapric material); 10 percent fiber broken face, less than 1 percent rubbed; massive; friable; neutral; clear smooth boundary.

Oa3—20 to 45 inches; black (5YR 2.5/1) (broken face and rubbed) muck (sapric material); 20 percent fiber broken face, 10 percent rubbed; massive; friable; slightly alkaline; abrupt smooth boundary.

Oa4—45 to 54 inches; black (5YR 2.5/1) (broken face and rubbed) muck (sapric material); 50 percent fiber broken face, 10 percent rubbed; massive; friable; 30 percent woody fibers; slightly alkaline; abrupt smooth boundary.

Oa5—54 to 80 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material); 10 percent fiber broken face, less than 1 percent rubbed; massive; friable; slightly alkaline.

The organic material is more than 51 inches thick. It is strongly acid to slightly alkaline.

The surface tier has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2.

The subsurface and lower tiers have hue of 5YR to 10YR or are neutral in hue. They have value of 2 to 3 and chroma of 0 to 2.

Mancelona Series

The Mancelona series consists of somewhat excessively drained soils on outwash plains, stream terraces, moraines, and kames. These soils formed in sandy and gravelly material (fig. 22). Permeability is moderately rapid in the upper part of the profile and very rapid in the substratum. Slope ranges from 0 to 70 percent.

Figure 22.—Typical profile of a Mancelona loamy sand. Depth is marked in inches.

Taxonomic classification: Sandy, mixed, frigid Alfic Haplorthods

Typical pedon of Mancelona loamy sand, 0 to 6 percent slopes, on a 3 percent south-facing slope in a forested area; at an elevation of 1,197 feet; 1,090 feet north and 500 feet east of the southwest corner of sec. 26, T. 31 N., R. 1 W.; north part of Charlton Township; USGS Saunders Creek Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 01 minute 44.94 seconds N. and long. 84 degrees 23 minutes 56.12 seconds W., NAD 27:

A—0 to 2 inches; black (N 2.5/0) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many fine and medium and common coarse roots; about 4 percent fine and

medium gravel; moderately acid; abrupt wavy boundary.

E—2 to 3 inches; pinkish gray (7.5YR 6/2) loamy sand, pale brown (10YR 6/3) dry; weak very fine subangular blocky structure; very friable; many fine and medium and common coarse roots; about 4 percent fine and medium gravel; strongly acid; abrupt broken boundary.

Bs1—3 to 15 inches; brown (7.5YR 4/4) loamy sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; friable; common fine and medium and few coarse roots; about 5 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bs2—15 to 25 inches; brown (7.5YR 4/4) gravelly sand; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; about 10 percent fine and medium gravel and 5 percent coarse gravel; moderately acid; clear wavy boundary.

Bt1—25 to 31 inches; strong brown (7.5YR 4/6) gravelly loamy sand; moderate medium subangular blocky structure; very friable; many distinct clay bridges between sand grains and clay coatings on rock fragments; about 10 percent fine and medium gravel, 5 percent coarse gravel, and 2 percent cobbles; slightly acid; clear broken boundary.

2Bt2—31 to 36 inches; dark brown (7.5YR 3/4) very gravelly loamy sand; moderate medium subangular blocky structure; very friable; many distinct and discontinuous clay coatings on the upper side of rock fragments; about 35 percent fine and medium gravel, 10 percent coarse gravel, and 2 percent cobbles; neutral; abrupt irregular boundary.

2C—36 to 80 inches; light brown (7.5YR 6/4), stratified very gravelly sand and pink (7.5YR 7/4) sand; single grain; loose; in individual strata, about 10 to 50 percent fine and medium gravel, 5 percent coarse gravel, and 2 percent cobbles; strongly effervescent; slightly alkaline.

The depth to carbonates ranges from 24 to 40 inches. The content of cobbles ranges from 0 to 7 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2. It is sand or loamy sand. The content of gravel ranges from 0 to 14 percent. Reaction ranges from very strongly acid to slightly alkaline. Some pedons have an Ap horizon, which has hue of 10YR, value of 4, and chroma of 2.

The E horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is sand or loamy sand. The content of gravel ranges from 3 to 20 percent. Reaction ranges from very strongly acid to slightly alkaline.

The Bs horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. It is sand, loamy sand, or the gravelly analogs of those textures. The content of gravel ranges from 3 to 20 percent. Reaction ranges from very strongly acid to slightly alkaline.

Some pedons have an E´ horizon. This horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 or 3. It is sand, loamy sand, or the gravelly analogs of those textures. The content of gravel ranges from 3 to 20 percent. Reaction ranges from very strongly acid to slightly alkaline.

The Bt horizon has hue of 7.5YR, value of 3 or 4, and chroma of 2 to 6. It is loamy sand, sandy loam, or the gravelly analogs of those textures. The content of gravel ranges from 3 to 20 percent. Reaction ranges from very strongly acid to slightly alkaline.

The 2Bt horizon has hue of 7.5YR, value of 3 or 4, and chroma of 4. It is loamy sand, sandy loam, or the gravelly or very gravelly analogs of those textures. The content of gravel ranges from 10 to 55 percent. Reaction ranges from very strongly acid to slightly alkaline.

The 2C horizon has hue of 10YR or 7.5YR, value of 3 to 7, and chroma of 3 or 4. It is commonly stratified very gravelly sand, gravelly sand, very gravelly coarse sand, coarse sand, or sand. The content of gravel ranges from 10 to 55 percent. Reaction is slightly alkaline or moderately alkaline.

Menominee Series

The Menominee series consists of well drained soils on moraines. These soils formed in 20 to 40 inches of sandy material and in the underlying loamy material. Permeability is rapid in the sandy material and moderate or moderately slow in the loamy material. Slope ranges from 12 to 70 percent.

Taxonomic classification: Sandy over loamy, mixed, active, frigid Alfic Haplorthods

Typical pedon of Menominee loamy sand, in an area of Menominee-Bamfield, sandy substratum-Blue Lake complex, 18 to 70 percent slopes, dissected; on a 25 percent west-facing slope in a forested area; at an elevation of 1,104 feet; 30 feet south and 60 feet east of the northwest corner of sec. 19, T. 32 N., R. 1 W.; east part of Corwith Township; USGS Hardwood Lake Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 09 minutes 23.57 seconds N. and long. 84 degrees 29 minutes 19.42 seconds W., NAD 27:

A—0 to 3 inches; black (N 2.5/0) loamy sand, dark grayish brown (10YR 4/2) dry; moderate medium

subangular blocky structure; very friable; many fine and medium and common coarse roots; about 5 percent fine and medium gravel; slightly acid; abrupt wavy boundary.

E—3 to 8 inches; grayish brown (10YR 5/2) loamy sand, light gray (10YR 7/2) dry; weak medium subangular blocky structure; very friable; common fine, medium, and coarse roots; about 5 percent fine and medium gravel; moderately acid; abrupt wavy boundary.

Bs1—8 to 13 inches; dark brown (7.5YR 3/4) loamy sand; moderate medium subangular blocky structure; very friable; common fine and medium and few coarse roots; 23 percent weakly cemented dark brown (7.5YR 3/2) ortstein occurring as columns 2 to 8 inches wide and extending into the Bs2 horizon; about 5 percent fine and medium gravel; moderately acid; clear irregular boundary.

Bs2—13 to 19 inches; dark yellowish brown (10YR 4/6) loamy sand; moderate medium subangular blocky structure; very friable; common fine and medium and few coarse roots; 20 percent weakly cemented dark brown (7.5YR 3/4) ortstein occurring as columns 2 to 8 inches wide; about 5 percent fine and medium gravel; moderately acid; clear irregular boundary.

E´—19 to 23 inches; light brownish gray (10YR 6/2) loamy sand, light gray (10YR 7/2) dry; weak fine subangular blocky structure; very friable, hard and brittle when dry; few fine, medium, and coarse roots; common medium and fine tubular pores; moderately acid; clear wavy boundary.

2E/B—23 to 27 inches; 70 percent light brownish gray (10YR 6/2) loamy sand, light gray (10YR 7/2) dry (E); weak fine subangular blocky structure; very friable, hard and brittle when dry; E material surrounding reddish brown (5YR 4/4) sandy clay loam (Bt); strong medium subangular blocky structure; firm; few fine and medium roots; common medium and fine tubular pores; common faint dark reddish brown (5YR 3/4) clay films on faces of peds; about 5 percent gravel; moderately acid; clear wavy boundary.

2Bt—27 to 36 inches; reddish brown (5YR 4/4) sandy clay loam; strong coarse subangular blocky structure; firm; few fine and medium roots; few fine tubular pores; many faint dark reddish brown (5YR 3/4) clay films on faces of peds and in root channels; about 7 percent gravel and 3 percent cobbles; neutral; clear wavy boundary.

2C1—36 to 48 inches; reddish brown (5YR 5/4) sandy clay loam; weak medium platy structure derived from deposition; friable; common fine prominent very pale brown (10YR 7/3) carbonates occurring as soft masses; about 7 percent gravel and 3 percent cobbles; slightly effervescent; moderately alkaline; gradual wavy boundary.

2C2—48 to 80 inches; light reddish brown (5YR 6/4) sandy clay loam; moderate thick platy structure derived from deposition; firm; common fine and medium prominent very pale brown (10YR 7/3) carbonates occurring as soft masses; about 7 percent gravel and 3 percent cobbles; strongly effervescent; moderately alkaline.

The depth to carbonates ranges from 32 to 45 inches. The sandy material ranges from 20 to 40 inches in thickness. The content of gravel ranges from 0 to 14 percent and the content of cobbles from 0 to 5 percent throughout the profile.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2.

The E horizon has hue of 7.5YR or 10YR, value of 5, and chroma of 2. It is loamy sand or sand.

The Bs1 horizon has hue of 7.5YR, value of 3 or 4, and chroma of 4. It is loamy sand or sand.

The Bs2 horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 4 to 6. It is loamy sand or sand.

The E part of the 2E/B horizon and the E´ horizon have hue of 10YR, value of 6, and chroma of 2 or 3. They are loamy sand or sand.

The Bt part of the 2E/B horizon and the 2Bt horizon have hue of 5YR or 7.5YR and value and chroma of 4. They are sandy clay loam or loam.

The 2C horizon has hue of 5YR, value of 5 or 6, and chroma of 4. It is sandy loam, loam, or sandy clay loam.

Millersburg Series

The Millersburg series consists of well drained soils on ground moraines, end moraines, and disintegration moraines. These soils formed in sandy and loamy material. Permeability is moderate or moderately rapid. Slope ranges from 6 to 18 percent.

Taxonomic classification: Coarse-loamy, mixed, active, frigid Haplic Glossudalfs

Typical pedon of Millersburg loamy sand, 6 to 18 percent slopes, on a 5 percent south-facing slope in a forested area; at an elevation of 900 feet; 1,866 feet north and 333 feet west of the southeast corner of sec. 2, T. 32 N., R. 2 E.; west-central part of Montmorency Township, Montmorency County; USGS Lake Geneva Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 11 minutes 24 seconds N. and long. 84 degrees 8 minutes 44 seconds W., NAD 27:

A—0 to 2 inches; black (N 2.5/0) loamy sand, black (N 2.5/0) dry; moderate medium granular structure; very friable; common fine and very fine and few medium roots; about 1 percent gravel; extremely acid; abrupt smooth boundary.

E—2 to 5 inches; brown (7.5YR 5/2) sand, pinkish gray (7.5YR 7/2) dry; weak fine subangular blocky structure; very friable; many fine and very fine and few medium and coarse roots; about 1 percent gravel; very strongly acid; clear wavy boundary.

Bw—5 to 10 inches; strong brown (7.5YR 4/6) loamy sand; moderate medium subangular blocky structure; very friable; common fine and very fine and few medium and coarse roots; about 2 percent gravel; strongly acid; clear wavy boundary.

E/B—10 to 18 inches; 65 percent pale brown (10YR 6/3) sand, pinkish gray (7.5YR 7/2) dry (E); surrounding reddish brown (5YR 4/4) sandy loam (Bt); moderate medium subangular blocky structure parting to moderate very fine subangular blocky; very friable; common fine and very fine roots; about 4 percent gravel; very strongly acid; clear irregular boundary.

B/E—18 to 26 inches; 75 percent reddish brown (5YR 4/4) sandy loam (Bt); surrounded by pinkish gray (7.5YR 7/2) loamy sand (E); moderate medium and coarse subangular blocky structure; firm in Bt part and friable in E part; many fine roots; clay bridging between sand grains; about 4 percent gravel; slightly acid; clear wavy boundary.

Bt—26 to 34 inches; yellowish red (5YR 4/6) sandy loam; moderate medium and coarse subangular blocky structure; friable; common fine roots; clay bridging between sand grains; about 1 percent gravel and 1 percent cobbles; slightly acid; clear broken boundary.

BC—34 to 43 inches; light reddish brown (5YR 6/3) sandy loam; moderate thick platy structure derived from deposition; friable; clay films around pebbles and clay bridging between sand grains; few fine roots; about 1 percent gravel; strongly effervescent; slightly alkaline; clear wavy boundary.

C—43 to 80 inches; light yellowish brown (10YR 6/4) loamy sand; massive; very friable; few yellowish brown (10YR 5/4) sand lenses about 2 inches long and $^{3}/_{4}$ inch thick; few fine roots; about 12 percent gravel; violently effervescent; moderately alkaline.

The depth to carbonates ranges from 30 to 60 inches. The content of cobbles ranges from 0 to 5 percent and the content of gravel from 0 to 14 percent throughout the profile. The A and E horizons are extremely acid to strongly acid.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 3. It is dominantly loamy sand, but the range includes sand.

The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 or 3. It is loamy sand or sand.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand or sand. Reaction ranges from very strongly acid to neutral.

The E part of the E/B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 or 3. It is sand or loamy sand. It makes up 55 to 75 percent of the horizon.

The Bt part of the E/B horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is sandy loam.

The E part of the B/E horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 6. It is sand or loamy sand. It makes up 15 to 25 percent of the horizon.

The Bt part of the B/E horizon has hue of 5YR or 7.5YR, value of 4, and chroma of 4 to 6. It is dominantly sandy loam but ranges to sandy clay loam.

The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is dominantly sandy loam or loam but in some pedons has thin subhorizons of sandy clay loam. Reaction ranges from slightly acid to slightly alkaline.

The BC horizon has hue of 5YR, value of 6, and chroma of 3 or 4. It is sandy loam.

The C horizon has hue of 5YR, 7.5YR, or 10YR; value of 5 or 6; chroma of 3 or 4. It is dominantly loamy sand but ranges to sandy loam. It has lenses of sand or gravel in some pedons. This horizon has carbonates in most pedons.

Morganlake Series

The Morganlake series consists of moderately well drained soils on moraines. These soils formed in 20 to 40 inches of sandy material and in the underlying loamy till (fig. 23). Permeability is moderately rapid or rapid in the sandy material and moderately slow in the loamy till. Slope ranges from 0 to 12 percent.

Taxonomic classification: Sandy over loamy, mixed, active, frigid Alfic Oxyaquic Haplorthods

Typical pedon of Morganlake loamy sand, 0 to 6 percent slopes, on a 2 percent west-facing slope in a forested area; at an elevation 1,150 feet; 2,180 feet north and 2,500 feet west of the southeast corner of sec. 13, T. 32 N., R. 2 W.; central part of Corwith Township; USGS Vanderbilt Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 9 minutes

Figure 23.—Typical profile of a Morganlake loamy sand. Depth is marked in inches.

43.71 seconds N. and long. 84 degrees 29 minutes 53.47 seconds W., NAD 27:

Oe—0 to 1 inch; black (7.5YR 2.5/1), partially decomposed leaf litter; neutral; abrupt broken boundary.

A—1 to 3 inches; very dark gray (7.5YR 3/1) loamy sand, dark grayish brown (10YR 4/2) dry; intermixed with 20 percent gray (7.5YR 6/1) uncoated sand grains; weak medium granular structure; very friable; common fine and medium and few coarse roots; about 3 percent fine and medium gravel; very strongly acid; abrupt wavy boundary.

E—3 to 10 inches; pinkish gray (7.5YR 6/2) sand, pinkish gray (7.5YR 7/2) dry; weak fine subangular blocky structure parting to single grain; very friable and loose; many fine and medium and common coarse roots; about 3 percent fine and medium gravel; strongly acid; abrupt wavy boundary.

Bhs—10 to 15 inches; dark brown (7.5YR 3/2) loamy sand; moderate fine subangular blocky structure; very friable; common fine and medium and few coarse roots; 20 percent very dark brown (7.5YR 2.5/3) moderately cemented ortstein occurring as columns 1 to 2 inches wide and extending into the E/B horizon; about 3 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bs—15 to 19 inches; brown (7.5YR 4/4) sand; weak medium subangular blocky structure parting to weak very fine subangular blocky; very friable; common fine and medium and few coarse roots; 25 percent strong brown (7.5YR 4/6) moderately cemented ortstein occurring as columns 1 to 2 inches wide; about 3 percent fine and medium gravel; strongly acid; abrupt wavy boundary.

E/B—19 to 39 inches; 85 percent brown (7.5YR 5/3) sand (E), pinkish gray (7.5YR 7/2) dry; single grain; loose; E material surrounding peds of brown (7.5YR 4/4) loamy sand (Bt); weak coarse subangular blocky structure; friable; clay bridging between sand grains; few fine and medium roots; 12 percent strong brown (7.5YR 4/6) moderately cemented ortstein occurring as columns 1 to 2 inches wide; about 3 percent fine and medium gravel; moderately acid; clear irregular boundary.

2B/E—39 to 49 inches; 70 percent reddish brown (5YR 4/4) sandy clay loam (Bt); strong coarse subangular blocky structure; firm; common distinct brown (7.5YR 5/4) clay films on faces of peds; B material surrounded by light brown (7.5YR 6/3) loamy sand (E), pinkish gray (7.5YR 7/2) dry; weak fine subangular blocky structure; very friable; few fine and medium roots; few very fine and fine vertical tubular pores; common fine distinct strong brown (7.5YR 4/6) masses of iron accumulation on faces of peds; about 5 percent gravel; moderately acid; clear wavy boundary.

2Bt—49 to 54 inches; brown (7.5YR 4/4) sandy clay loam; strong coarse subangular blocky structure; firm; few fine and medium roots; few very fine and fine vertical tubular pores; many faint brown (7.5YR 5/4) clay films on faces of peds; common fine and medium distinct strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 5 percent gravel; slightly acid; clear wavy boundary.

2C—54 to 80 inches; brown (7.5YR 5/4) sandy clay loam with pockets of light brown (7.5YR 6/3) very fine sandy loam; massive; firm; few fine and medium roots; few fine distinct light gray (7.5YR 7/1) threads of lime; about 5 percent gravel; violently effervescent; moderately alkaline.

The thickness of the sandy material ranges from 27 to 39 inches. The depth to carbonates ranges from 30

to more than 60 inches. The content of gravel ranges from 0 to 8 percent in the sandy material and from 3 to 12 percent in the loamy material. The depth to redoximorphic features ranges from 30 to 40 inches.

The A horizon has hue of 5YR to 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2. Reaction ranges from very strongly acid to slightly acid. Some pedons have an Ap horizon, which has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3.

The E horizon has hue of 7.5YR or 10YR and value of 5 to 7. It is sand or loamy sand. Reaction ranges from very strongly acid to slightly acid.

The Bhs horizon has hue of 5YR or 7.5YR, value of 2.5 or 3, and chroma of 2 or 3. It is sand or loamy sand. Reaction ranges from very strongly acid to slightly acid.

The Bs horizon has hue of 5YR, value of 3 to 5, and chroma of 4 to 6 or hue of 7.5YR, value of 3 to 5, and chroma of 4. It is sand or loamy sand. Reaction ranges from very strongly acid to slightly acid.

The E part of the E/B and 2B/E horizons has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 2 or 3. Reaction ranges from moderately acid to moderately alkaline. Some pedons have an E´ or 2E´ horizon. The E´ horizon is sand or loamy sand, and the 2E´ horizon is loamy sand or sandy loam.

The 2Bt horizon and the 2B part of the 2E/B or 2B/E horizon have hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 4 or 5. They are loam, sandy clay loam, or clay loam. Reaction ranges from moderately acid to moderately alkaline.

The 2C horizon has hue of 5YR or 7.5YR. It is loam, sandy clay loam, or clay loam. Reaction ranges from moderately acid to moderately alkaline.

Mossback Series

The Mossback series consists of well drained soils on moraines. These soils formed in loamy material underlain by sandy material (fig. 24). Permeability is moderate in the loamy material and rapid in the sandy substratum. Slope ranges from 0 to 35 percent.

Taxonomic classification: Fine-loamy, mixed, active, frigid Haplic Glossudalfs

Typical pedon of Mossback sandy loam, 12 to 18 percent slopes, on a 17 percent north-facing slope in a forested area; at an elevation of 1,294 feet; 590 feet south and 100 feet west of the center of sec. 24, T. 31 N., R. 3 W.; Livingston Township; USGS Sparr Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 03 minutes 41.02 seconds N. and long. 84 degrees 37 minutes 26.00 seconds W., NAD 27:

Figure 24.—Typical profile of a Mossback sandy loam. Depth is marked in inches.

A—0 to 3 inches; black (10YR 2/1) sandy loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; friable; many fine and common medium and coarse roots; about 3 percent gravel; very strongly acid; abrupt wavy boundary.

Bw—3 to 11 inches; dark yellowish brown (10YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; common fine, medium, and coarse roots; few prominent black (10YR 2/1) organic coatings in root channels and worm burrows; about 3 percent gravel; strongly acid; clear wavy boundary.

E—11 to 13 inches; pale brown (10YR 6/3) loamy sand, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; friable, hard and brittle when dry; few fine and common medium and coarse roots; few fine tubular pores; few prominent black (10YR 2/1) organic coatings

in root channels and worm burrows; about 3 percent gravel; strongly acid; clear wavy boundary.

E/B—13 to 18 inches; 80 percent grayish brown (10YR 5/2) loamy sand (E), light gray (10YR 7/2) dry; few fine tubular pores; E material surrounding reddish brown (5YR 4/4) sandy loam (Bt); weak medium subangular blocky structure; friable; common fine and medium tubular pores; few prominent black (10YR 2/1) organic coatings in root channels and worm burrows; about 5 percent gravel; moderately acid; clear irregular boundary.

Bt—18 to 24 inches; reddish brown (5YR 4/4) sandy clay loam; strong coarse subangular blocky structure; firm; few fine and medium roots; common fine and medium tubular pores; many faint dark reddish brown (5YR 3/4) clay films on faces of peds and in root channels; few prominent black (10YR 2/1) organic coatings in root channels and worm burrows; about 5 percent gravel; neutral; clear wavy boundary.

BC—24 to 44 inches; brown (7.5YR 4/4) sandy loam; moderate coarse subangular blocky structure; friable; very few fine and medium roots; common distinct dark reddish brown (5YR 3/4) clay films on faces of peds and in root channels; about 5 percent gravel and 2 percent cobbles; slightly effervescent; slightly alkaline; gradual wavy boundary.

C—44 to 74 inches; brown (7.5YR 5/4) sandy loam; massive; friable; few distinct very pale brown (10YR 7/3) carbonate coatings on faces of peds and few fine soft masses of carbonate accumulation; about 5 percent gravel and 2 percent cobbles violently effervescent; moderately alkaline; clear wavy boundary.

2C—74 to 80 inches; yellowish brown (10YR 5/4) sand and gravelly loamy sand; single grain; loose; about 20 percent fine gravel; slightly effervescent; neutral.

The depth to carbonates ranges from 24 to 35 inches. The content of gravel ranges from 1 to 14 percent in the loamy material and from 0 to 50 percent in the sandy substratum. The content of cobbles ranges from 0 to 8 percent throughout the profile.

The A horizon has hue of 10YR or 7.5YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2.

The E horizon and the E part of the E/B horizon have hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 2 or 3. They are loamy sand or sandy loam. Some pedons have an E´ horizon.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. It is loamy sand or sandy loam.

The Bt horizon and the B part of the E/B horizon have hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. They are dominantly sandy clay loam or loam but have thin layers of sandy loam in some pedons.

The BC horizon has value of 4 or 5 and chroma of 4 to 6.

The C horizon has value of 5 or 6 and chroma 3 to 6.

The 2C horizon is sand, loamy sand, stratified sand and loamy sand, or the gravelly or very gravelly analogs of those textures.

Ossineke Series

The Ossineke series consists of moderately well drained soils on moraines. These soils formed in loamy material underlain by sandy material. Permeability is moderate in the loamy material and rapid in the sandy substratum. Slope ranges from 0 to 12 percent.

Taxonomic classification: Fine-loamy, mixed, semiactive, frigid Oxyaquic Glossudalfs

Typical pedon of Ossineke fine sandy loam, sandy substratum, 0 to 6 percent slopes, on a 1 percent north-facing slope in a hayfield; at an elevation of 1,438 feet; 670 feet south and 1,840 feet east of the northwest corner of sec. 12, T. 31 N., R. 1 W.; north part of Charlton Township; USGS Saunders Creek Michigan 7.5-minute topographic quadrangle; lat. 54 degrees 00 minutes 45.26 seconds N. and long. 84 degrees 22 minutes 50.32 seconds W., NAD 27:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable; common fine and medium roots; about 3 percent gravel and 3 percent cobbles; slightly acid; abrupt smooth boundary.

Bw—8 to 13 inches; brown (7.5YR 4/4) sandy loam; weak medium subangular blocky structure; very friable; common fine and medium roots; about 5 percent gravel and 3 percent cobbles; neutral; abrupt irregular boundary.

B/E—13 to 21 inches; 55 percent dark reddish brown (5YR 3/4) sandy clay loam (Bt); moderate medium subangular blocky structure; firm; few fine tubular pores; few distinct patchy brown (7.5YR 4/4) clay films on faces of peds and in pores; B material surrounded by brown (7.5YR 5/2) sandy loam (E), pinkish gray (7.5YR 7/2) dry; weak medium subangular blocky structure; friable, hard and brittle when dry; common fine and medium roots; few fine vesicular pores; about 5 percent gravel

and 3 percent cobbles; slightly acid; clear irregular boundary.

Bt—21 to 38 inches; dark reddish brown (5YR 3/4) sandy clay loam; moderate coarse subangular blocky structure parting to moderate fine angular blocky; firm; common fine and medium roots; few fine tubular pores; common distinct discontinuous brown (7.5YR 4/4) clay films on faces of peds; few fine prominent strong brown (7.5YR 5/6) masses of iron accumulation in the matrix at the base of the horizon; about 5 percent gravel and 3 percent cobbles; neutral; gradual wavy boundary.

BC—38 to 51 inches; brown (7.5YR 5/4) sandy loam; massive; friable; few fine and medium roots; few fine tubular pores; few fine prominent strong brown (7.5YR 5/6 and 5/8) masses of iron accumulation in the matrix; about 5 percent gravel and 3 percent cobbles; slightly alkaline; gradual wavy boundary.

C1—51 to 77 inches; brown (7.5YR 5/4) sandy loam; massive; friable; common fine prominent strong brown (7.5YR 5/6 and 5/8) masses of iron accumulation in the matrix; about 5 percent gravel and 3 percent cobbles; violently effervescent; slightly alkaline; abrupt wavy boundary.

2C2—77 to 80 inches; yellowish brown (10YR 5/4) sand; single grain; loose; about 5 percent gravel and 3 percent cobbles; moderately alkaline.

The depth to carbonates ranges from 31 to 51 inches. Depth to the sandy substratum ranges from 60 to 77 inches. The content of gravel ranges from 1 to 8 percent and the content of cobbles from 0 to 3 percent throughout the profile. Reaction ranges from moderately acid to slightly alkaline in the upper part of the profile and is slightly alkaline or moderately alkaline in the substratum.

The Ap horizon has hue of 7.5YR or 10YR, value of 3, and chroma of 1 or 2. Some pedons have an A horizon.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is sandy loam or fine sandy loam.

The E horizon and the E part of the E/B horizon have hue of 7.5YR or 10YR and chroma of 2 or 3. They are sandy loam or fine sandy loam.

The Bt horizon and the B part of the E/B horizon have hue of 5YR or 7.5YR and chroma of 3 or 4. They are loam or sandy clay loam.

The BC and C horizons have hue of 5YR or 7.5YR and chroma of 3 or 4. They are sandy loam or loam.

The 2C horizon has hue of 7.5YR or 10YR and chroma of 4 or 5. It is sand or loamy sand.

Rubicon Series

The Rubicon series consists of excessively drained soils on moraines, stream terraces, and outwash plains. These soils formed in thick deposits of sandy material. Permeability is rapid. Slope ranges from 0 to 70 percent.

Taxonomic classification: Sandy, mixed, frigid Entic Haplorthods

Typical pedon of Rubicon sand, 0 to 6 percent slopes, on a 2 percent southeast-facing slope in a forested area; at an elevation of 1,221 feet; 170 feet south and 2,680 feet east of the northwest corner of sec. 31, T. 29 N., R. 4 W.; south part of Hayes Township; USGS Frederic Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 52 minutes 19.11 seconds N. and long. 84 degrees 50 minutes 15.26 seconds W., NAD 27:

A—0 to 1 inch; very dark gray (10YR 3/1) sand, dark gray (10YR 4/1) dry; weak fine granular structure; very friable; many fine and medium and common coarse roots; very strongly acid; abrupt wavy boundary.

E—1 to 4 inches; grayish brown (10YR 5/2) sand, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; very friable; many fine and common medium and coarse roots; about 2 percent fine and medium gravel; very strongly acid; clear wavy boundary.

Bs1—4 to 10 inches; brown (7.5YR 4/4) sand; weak very fine subangular blocky structure; very friable; common fine and medium and few coarse roots; about 2 percent fine and medium gravel; strongly acid; clear wavy boundary.

Bs2—10 to 16 inches; dark yellowish brown (10YR 4/6) sand; weak very fine subangular blocky structure; very friable; 14 percent moderately cemented brown (7.5YR 4/4) and weakly cemented very dusky red (2.5YR 2.5/2) ortstein occurring as columns 2 to 9 inches wide and extending into the C horizon; about 2 percent fine and medium gravel; strongly acid; clear wavy boundary.

BC—16 to 31 inches; brownish yellow (10YR 6/6) sand; weak very fine subangular blocky structure; very friable; 37 percent moderately cemented brown (7.5YR 4/4) and weakly cemented very dusky red (2.5YR 2.5/2) ortstein occurring as columns 2 to 9 inches wide; about 2 percent fine and medium gravel; strongly acid; gradual wavy boundary.

C—31 to 80 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; 11 percent moderately cemented brown (7.5YR 4/4) and weakly cemented very dusky red (2.5YR 2.5/2) ortstein occurring as columns 2 to 9 inches wide; about 3 percent fine and medium gravel; moderately acid.

The content of gravel ranges from 0 to 14 percent throughout the profile. Reaction ranges from very strongly acid to moderately acid throughout the profile. The Bs, BC, and C horizons have 0 to 40 percent ortstein, which occurs as columns extending through the horizons.

The A horizon has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 3. Some pedons have an Ap horizon, which has hue of 10YR, value of 3 to 4, and chroma of 2 or 3.

The E horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 1 or 2.

The Bs1 horizon has hue of 7.5YR and value and chroma of 3 or 4. Value and chroma of 3 do not occur together.

The Bs2 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 8.

The BC horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 6. The C horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. In some pedons the BC and C horizons have thin strata of coarse sand or coarse sand and gravel.

Slade Series

The Slade series consists of somewhat poorly drained soils on moraines. These soils formed in thick deposits of loamy material. Permeability is moderately slow. Slope ranges from 0 to 3 percent.

Taxonomic classification: Fine-loamy, mixed, active, frigid Aquic Glossudalfs

Typical pedon of Slade loam, 0 to 3 percent slopes, on a 3 percent southeast-facing slope in a hayfield; at an elevation of 1,190 feet; 840 feet north and 2,350 feet east of the southwest corner of sec. 27, T. 31 N., R. 2 W.; Dover Township; USGS Sparr Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 02 minutes 34.53 seconds N. and long. 84 degrees 30 minutes 51.42 seconds W., NAD 27:

Ap—0 to 10 inches; very dark brown (10YR 2/2) loam, light brownish gray (10YR 6/2) dry; moderate fine and medium subangular blocky structure; friable; many fine roots; about 3 percent gravel; strongly acid; abrupt smooth boundary.

B/E—10 to 12 inches; 70 percent dark brown (7.5YR 3/4) clay loam (Bt); moderate medium subangular blocky structure; firm; common distinct dark reddish brown (5YR 3/2) clay films on faces of peds; B material penetrated by columns of brown (7.5YR 5/2) sandy loam (E), pinkish gray (7.5YR 7/2) dry; common medium prominent black (N 2.5/0) earthworm casts; common medium prominent greenish gray (5GY 6/1) iron depletions in the matrix; common medium prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 3 percent gravel; strongly acid; abrupt broken boundary.

Bt1—12 to 16 inches; dark reddish brown (5YR 3/3) clay loam; moderate medium subangular blocky structure; firm; common faint dark reddish brown (5YR 3/2) clay films on faces of peds; common medium prominent greenish gray (5GY 6/1) iron depletions in the matrix; many medium prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 3 percent gravel; strongly acid; clear wavy boundary.

Bt2—16 to 21 inches; dark brown (7.5YR 3/4) clay loam; moderate medium subangular blocky structure; firm; many prominent dark reddish brown (5YR 3/2) clay films on faces of peds; common medium prominent black (N 2.5/0) earthworm casts; common fine prominent black (N 2.5/0) accumulations of iron and manganese oxide; common medium prominent greenish gray (5GY 6/1) iron depletions in the matrix; many medium prominent strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 3 percent gravel; strongly acid; gradual wavy boundary.

Bt3—21 to 28 inches; brown (7.5YR 5/4) clay loam; moderate coarse subangular blocky structure; firm; common prominent dark reddish brown (5YR 3/2) clay films on faces of peds; many medium prominent greenish gray (5GY 6/1) and many coarse prominent light brown (7.5YR 6/3) iron depletions in the matrix; many medium distinct strong brown (7.5YR 4/6) masses of iron accumulation in the matrix; about 3 percent gravel; few fine prominent very pale brown (10YR 7/3) soft masses of carbonate accumulation on faces of peds; neutral; abrupt wavy boundary.

C1—28 to 36 inches; reddish brown (5YR 4/4) loam with pockets of reddish brown (5YR 4/4) very fine sandy loam; moderate thick platy structure derived from deposition; firm; many fine prominent greenish gray (5GY 6/1) iron depletions in the matrix; many fine prominent strong brown (7.5YR 5/6) masses of iron accumulation in the matrix; about 1 percent gravel; strongly effervescent; moderately alkaline; gradual wavy boundary.

C2—36 to 80 inches; brown (10YR 5/3) loam with pockets of reddish brown (5YR 4/4) very fine sandy loam; moderate thick platy structure derived from deposition; firm; about 1 percent gravel; strongly effervescent; moderately alkaline.

The depth to carbonates ranges from 24 to 28 inches. The content of gravel ranges from 1 to 5 percent and the content of cobbles from 0 to 5 percent throughout the profile. Reaction ranges from very strongly acid to neutral in the upper part of the profile and is moderately alkaline in the substratum.

The Ap horizon has hue of 10YR, value of 2 or 3, and chroma of 2.

The Bt horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 3 or 4. It is clay loam or sandy clay loam.

The C horizon has hue of 5YR to 10YR, value of 4 or 5, and chroma of 3 or 4.

Tawas Series

The Tawas series consists of very poorly drained soils in depressions on outwash plains and moraines. These soils formed in organic material over sandy material. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Slope ranges from 0 to 2 percent.

Taxonomic classification: Sandy or sandy-skeletal, mixed, euic, frigid Terric Haplosaprists

Typical pedon of Tawas muck, in an area of Tawas-Lupton mucks; in a nearly level forested area; at an elevation of 1,211 feet; 1,340 feet south and 1,510 feet west of the northeast corner of sec. 31, T. 29 N., R. 4 W.; south part of Hayes Township; USGS Frederic Michigan 7.5-minute topographic quadrangle; lat. 44 degrees 52 minutes 09.54 seconds N. and long. 84 degrees 50 minutes 08.12 seconds W., NAD 27:

Oa1—0 to 9 inches; black (10YR 2/1) (broken face and rubbed) muck (sapric material); 10 percent fiber broken face, less than 1 percent rubbed; weak fine subangular blocky structure; friable; many fine and medium and common coarse roots; primarily herbaceous fibers; slightly acid; clear smooth boundary.

Oa2—9 to 12 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material); 20 percent fiber broken face, 10 percent rubbed; weak fine subangular blocky structure; very friable; primarily herbaceous fibers; slightly acid; clear smooth boundary.

Oa3—12 to 18 inches; black (N 2.5/0) (broken face and rubbed) muck (sapric material); 50 percent fiber broken face, 10 percent rubbed; massive; friable; 5 percent woody fibers; slightly acid; clear smooth boundary.

Oa4—18 to 24 inches; very dark gray (10YR 3/1) (broken face and rubbed) muck (sapric material); 40 percent fiber broken face, less than 1 percent rubbed; massive; friable; slightly acid; clear smooth boundary.

Cg1—24 to 26 inches; dark gray (5Y 4/1) sand; single grain; loose; black (N 2.5/0) organic stains throughout; slightly acid; clear wavy boundary.

Cg2—26 to 80 inches; dark gray (5Y 4/1) sand; single grain; loose; about 10 percent fine and medium gravel; slightly acid.

The depth to sandy material ranges from 22 to 51 inches. Reaction ranges from very strongly acid to slightly acid in the organic material.

The surface tier has hue of 7.5YR or 10YR or is neutral in hue. It has value of 2 to 3 and chroma of 0 to 2.

The subsurface and bottom tiers have hue of 10YR to 5YR or are neutral in hue. They have value of 2 to 3 and chroma of 0 to 2.

The C horizon has hue of 2.5Y or 5Y, value of 3 or 4, and chroma of 1 or 2. It is sand or loamy sand. The content of gravel ranges from 0 to 10 percent. Reaction is moderately acid or slightly acid.

Udipsamments

Udipsamments consist of well drained to excessively drained, rapidly permeable soils on outwash plains, moraines, deltas, and lake plains. These soils formed in sandy deposits. Slope ranges from 0 to 8 percent.

Typical pedon of Udipsamments, 1,950 feet west and 500 feet south of the northeast corner of sec. 16, T. 32 N., R. 2 E., Montmorency Township; USGS Lake Geneva Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 10 minutes 9 seconds N. and long. 84 degrees 11 minutes 36 seconds W., NAD 27:

Bw—0 to 7 inches; dark yellowish brown (10YR 4/4) sand; weak fine subangular blocky structure; very friable; common very fine and fine and few medium and coarse roots; 5 percent gravel; extremely acid; clear wavy boundary.

BC—7 to 13 inches; yellowish brown (10YR 5/6) sand; weak fine and medium subangular blocky structure; very friable; few very fine roots; 1 percent gravel; extremely acid; clear wavy boundary.

C1—13 to 65 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; 1 percent gravel; extremely acid; clear wavy boundary.

C2—65 to 81 inches; pale brown (10YR 6/3) sand;

single grain; loose; a few strong brown (7.5YR 5/6) color bands 1/16 inch thick; 1 percent gravel; very strongly acid.

Udorthents

Udorthents consist of well drained to excessively drained, rapidly permeable soils on outwash plains, moraines, deltas, and lake plains. These soils formed in loamy deposits. Slope ranges from 0 to 8 percent.

Typical pedon of Udorthents, 2,600 feet east and 1,600 feet north of the southwest corner of sec. 24, T. 31 N., R. 4 E., Hillman Township; USGS Hillman Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 3 minutes 49 seconds N. and long. 83 degrees 53 minutes 20 seconds W., NAD 27:

Ap—0 to 42 inches; dark grayish brown (10YR 4/2) sandy loam; moderate medium granular structure; very friable; 8 percent gravel and 5 percent cobbles; neutral; clear irregular boundary.

Bt/E—42 to 48 inches; 70 percent reddish brown (5YR 4/4) clay loam (Bt); strong medium subangular blocky structure; friable; Bt material surrounded by pinkish gray (5YR 6/2) loamy sand (E); friable; 8 percent gravel and 5 percent cobbles; neutral; clear wavy boundary.

Bt—48 to 54 inches; reddish brown (5YR 4/4) clay loam; strong medium subangular blocky structure; firm; many prominent reddish brown (5YR 4/3) clay films on faces of peds; 8 percent gravel and 5 percent cobbles; slightly alkaline; clear wavy boundary.

C—54 to 80 inches; brown (10YR 5/3) sandy loam; weak medium subangular blocky structure; very friable; 8 percent gravel and 5 percent cobbles; moderately alkaline.

Wakeley Series

The Wakeley series consists of very poorly drained soils on lake plains. These soils formed in sandy material underlain by clayey material. Permeability is rapid in the sandy material and slow in the clayey material. Slope ranges from 0 to 2 percent.

Taxonomic classification: Sandy over clayey, mixed, nonacid, semiactive, frigid Aeric Epiaquents

Typical pedon of Wakeley muck, on a 1 percent northeast-facing slope in a forested area; at an elevation of 1,075 feet; 2,280 feet south and 545 feet east of the northwest corner of sec. 35, T. 32 N., R. 3 W.; east part of Corwith Township; USGS Gaylord Michigan 7.5-minute topographic quadrangle; lat. 45 degrees 07 minutes 17.97 seconds N. and long. 84 degrees 39 minutes 03.18 seconds W., NAD 27:

Oa—0 to 7 inches; black (10YR 2/1) (broken face and rubbed) muck (sapric material); 40 percent woody and herbaceous fiber broken face, 5 percent rubbed; moderate fine and medium subangular blocky structure; friable; many fine and medium and common coarse roots; strongly acid; abrupt wavy boundary.

Cg—7 to 12 inches; grayish brown (2.5Y 5/2) sand; weak medium subangular blocky structure; very friable; common fine and medium and few coarse roots; common medium prominent dark yellowish brown (10YR 4/6) and yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; about 1 percent fine gravel; moderately acid; clear wavy boundary.

C1—12 to 21 inches; brown (10YR 5/3) sand; single grain; loose; few fine and medium roots; common medium distinct yellowish brown (10YR 5/6) masses of iron accumulation in the matrix; about 1 percent fine gravel; moderately acid; abrupt wavy boundary.

2C2—21 to 25 inches; reddish brown (5YR 5/4), stratified silty clay with 30 percent loamy sand; massive; firm; many coarse prominent greenish gray (5GY 5/1) gley coatings in cracks and root channels; common medium distinct yellowish red (5YR 5/6) masses of iron accumulation in the matrix; slightly alkaline; clear wavy boundary.

2C3—25 to 64 inches; reddish brown (5YR 5/4) silty clay; massive; firm; many coarse prominent greenish gray (5GY 5/1) gley coatings in cracks and root channels; common medium distinct yellowish red (5YR 5/6) masses of iron accumulation in the matrix; violently effervescent; moderately alkaline; clear wavy boundary.

2C4—64 to 80 inches; brown (7.5YR 5/4) silty clay loam; massive; firm; few fine prominent greenish gray (5GY 5/1) gley coatings in fractures; violently effervescent; moderately alkaline.

The depth to clayey lacustrine sediments ranges from 18 to 36 inches. The content of gravel ranges from 0 to 5 percent throughout the profile.

The Oa horizon has hue of 10YR or is neutral in hue. It has value of 2 or 2.5 and chroma of 0 or 1. It is 3 to 7 inches thick.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 4. It is sand or loamy sand.

The Cg horizon has hue of 2.5Y, value of 5 or 6, and chroma of 1 or 2.

The 2C horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 2 to 4. It is dominantly clay or silty clay, but in some pedons it is silty clay loam or clay loam or has thin strata of loamy or sandy material.

Formation of the Soils

The paragraphs that follow relate the factors of soil formation to the soils in Otsego County and explain the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors. These are the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material accumulated and has existed since accumulation; the plant and animal life on and in the soil; the topography; and the length of time that the processes of soil formation have acted on the parent material (Jenny, 1941). The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Climate and plant and animal life are the active forces of soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers called horizons. The effects of climate and plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is always needed for the differentiation of soil horizons.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. The dominant parent materials of the soils in Otsego County are glacial outwash and glacial till. Some of the soils formed in alluvium or in organic material.

Glacial outwash is the parent material of the soils in about 58 percent of the county. Glacial meltwater deposited this material in areas of outwash plains, outwash channels, stream terraces, kames, and kame terraces throughout the county. The texture of this material varies greatly. The size of the particles varies according to the speed of stream that carried them. As the water slowed down, the coarser particles were deposited first. Only the finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water.

Many of the outwash soils are underlain by calcareous coarse sand and gravel. The rock fragments in the outwash tend to be rounded, having no sharp edges. Outwash deposits generally consist of layers of particles having similar sizes, such as loamy sand, sand, gravel, and other coarse particles. The outwash in Otsego County ranges from sand, the dominant material of the Grayling and Rubicon soils, to the loamy sand of the Blue Lake and Islandlake soils and the gravelly sandy loam of the Mancelona soils.

Glacial till is the parent material of the soils in about 28 percent of the county. It is the unsorted material transported and deposited directly by glaciers with a minimum of water action. It is a mixture of all sizes of particles, from clay-size particles to large stones and boulders. The rock fragments in glacial till have sharp corners, indicating that they have not been worn by water. All exposed glacial till in Otsego County is a result of the various Wisconsinan glacial advances. The ice melted and receded from the survey area 10,000 to 12,000 years ago.

The sandy loam till of the dissected moraines, deposited by the Huron Lobe during the Port Bruce advance, is the primary parent material of Feldhauser soils. This till is underlain by sandy glacial drift, which is the primary parent material of Blue Lake and Kalkaska soils, in the southwestern part of the county. The till has about 0 to 15 percent gravel, 70 percent sand, 15 percent silt, and 5 percent clay. It is friable and is yellowish brown and strong brown. The calcium carbonate equivalent is about 0 percent.

The loam and clay loam till of the Johannesburg Moraine, deposited by the Huron Lobe during the Port Huron advance, is the primary parent material of Bamfield, Mossback, Kent, and Ossineke soils. This till has about 3 percent gravel, 35 percent sand, 35 percent silt, and 30 percent clay. It is firm and is yellowish brown and brown. The calcium carbonate equivalent is about 15 percent.

The loamy sand till of kamelike masses in the channeled uplands, deposited by the Valders

readvancement of the Huron Lobe, is the primary parent material of Leelanau soils. This till has 0 to 15 percent gravel, about 65 percent sand, 25 percent silt, and 10 percent clay. It is friable and is yellowish brown and brown. The calcium carbonate equivalent is about 5 percent.

Alluvium is the parent material of the soils in less than 1 percent of Otsego County. Because the landscape in the county is quite young and the county is the headwaters of the river systems, most of the flood plains are narrow and little alluvial material has accumulated. The material that has accumulated varies in texture, depending on the source of the material and the speed of the water from which it was deposited. Alluvium deposited by a swift stream is coarser textured than that deposited by a slow, sluggish stream. The alluvial material is deposited on the present flood plains, natural levees, and first bottoms.

The soils that formed in alluvium are the youngest soils in the county and typically have no profile development. These soils and their parent material are characterized by an irregular decrease in content of organic matter with increasing depth. Ausable soils formed in sandy alluvium with strata of muck, and Bowstring soils formed in mucky alluvium with strata of sand.

Organic material is the parent material of the soils in about 9 percent of the county. It is made up of the remains of decomposed plant materials. After the glaciers receded from the survey area, water remained standing in open and closed depressions on outwash plains, in outwash channels, on moraines, and in back swamps on flood plains. Because of the waterlogged environment, the water-tolerant trees and grasses and sedges that grew around the edges of the depressions did not rapidly decompose after they died. Eventually, the plant remains filled the depressions and slowly decomposed to form muck. Tawas, Lupton, and Leafriver soils are examples of soils that formed in organic material.

Climate

The soils in Otsego County probably formed under the influence of a mid-continental, humid climate very similar to that of the present. This climate affected soil formation mainly through its effect on the type of vegetation. It favored forest growth in the county. The climate also affected soil temperature and moisture, which in turn affected the chemical and biological processes of soil formation. The soil temperature regime in the county is frigid. The soil temperature averages less than 8 degrees C (47 degrees F). The primary soil moisture regime in the county is udic, which implies that the precipitation is evenly distributed throughout the year and that water moves down through the soil at some time in most years. In some areas the moisture regime is aquic, which means that at least the lower horizons of the soil are saturated during part of the growing season. Low-chroma redoximorphic features are evidence of an aquic regime.

Climate is a major factor in determining the extent of soil formation. It affects the rate and intensity of hydrolysis, carbonation, oxidation, reduction, and other important chemical reactions in the soil. Temperature and rainfall affect the leaching and translocation of soil minerals and clay. All of the climatic factors affect the type and abundance of native vegetation, which in turn affects soil formation.

Local conditions can somewhat modify or ameliorate the effects of the general climate. The microclimate on south-facing slopes is generally warmer and less humid than that on nearby north-facing slopes. Also, areas close to large bodies of water tend to have a narrower range of temperature variations and are more humid than areas some distance away. Poorly drained soils in low areas are wetter and colder than the soils in most of the surrounding areas.

Plant and Animal Life

Plant and animal life has had an important impact on soil formation and degradation in Otsego County. Plant life is a driving force in soil formation. As plants grow old and die, their remains accumulate on the surface, decay, and eventually become organic matter. The stored nutrients are released to the upper layers of the soil.

Grasses tend to have large, fibrous root systems that add large amounts of organic matter to the surface layer. Trees tend to have deep root systems that recycle nutrients back to the surface from deep in the soil profile. As they decay, the roots of the plants provide channels for the downward movement of water through the soil. The surface layer of the soils that formed under a forest cover tends to be thin and light in color, and the surface layer of the soils that formed under grasses is thick and dark.

Most of the soils in the county formed under a forest plant community, mainly coniferous trees or a mixture of coniferous and deciduous trees. Differences in natural soil drainage and minor variations in parent material affected the composition of the species. The excessively drained Grayling soils were covered mainly with jack pine but had scattered black oaks. The somewhat excessively drained Kalkaska and Islandlake soils were covered mainly with white pine,

sugar maple, red maple, and American beech. The well drained Bamfield, Mossback, and Menominee soils were covered mainly with white pine, hemlock, sugar maple, and basswood. The very poorly drained Deford, Leafriver, and Tawas soils were covered with northern whitecedar, red maple, balsam fir, and quaking aspen. These soils have a thick, dark surface layer because of very poor drainage. The lack of air under a saturated condition reduces the rate of decomposition, allowing the organic matter to accumulate.

The burrows of earthworms act as large pores that allow water and air movement in the soil. Bacteria and fungi in the soil help to break down the organic matter, releasing nutrients, which are used by growing plants.

Human activities have had a tremendous impact on the soil resource since Otsego County was settled. The recent activities have augmented or disrupted the natural systems and in general increased the rate of organic matter decay. The clearing of the timber has removed and changed the protective plant cover. Extensive wildfires have completely consumed the organic matter in some soils. In farmed areas cultivation has increased the susceptibility of the more sloping soils to erosion. As land is brought under cultivation, the runoff rate increases and the infiltration rate decreases. As a result, accelerated erosion has removed all or part of the original surface layer with its organic matter and nutrients. Sheet erosion, which is the most prevalent type of erosion in the county, is insidious in that it causes the removal of a thin layer of soil across entire fields and is almost impossible to observe. Cultivation generally removes all traces of sheet or rill erosion, but not its effect. In some areas, deep gullies have formed and the eroded soil material has been deposited on the lower slopes.

Fire and erosion have changed the structure and consistence of the surface layer in many soils and reduced the content of organic matter and the level of natural fertility. This destruction has been so extensive that the original tree species are no longer able to grow in many areas.

In areas that are still farmed, there are many management measures that can decrease the susceptibility of the soils to erosion, ameliorate the effects of erosion, and increase productivity. Many soils are more productive than they were naturally because applications of fertilizer and lime have overcome inherent deficiencies in plant nutrients. Conservation tillage, green manure crops, and cover crops all reduce the hazard of erosion and help to rebuild topsoil by adding organic matter and helping to maintain or improve the tilth of the surface layer. In other areas engineering solutions, such as terraces, water- and sediment-control basins, diversions, and grassed waterways, help to control concentrated waterflow and the resultant gully erosion.

Topography

The topography of Otsego County indirectly affects soil formation through its effect on drainage, the rate of erosion, the kind of plant cover, and the soil temperature. The county is dominated by the topography of outwash plains and glacial moraines. The central and southeastern parts of the county are dominated by a large outwash plain. In this area slopes range from nearly level to undulating. These slopes are dominantly simple. Small closed depressions are in some areas. The southwestern part of the county as well as the flanks of the Johannesburg Moraine and the channeled uplands are nearly level to very steep. The slopes tend to be complex, however, and natural drainageways are abundant. Soil temperature tends to be lower on north-facing slopes and in low areas where cold air drains.

The color of the subsoil is affected by natural drainage. Water tends to run off the steeper soils, which generally are deeper to a water table than the less sloping soils. The well drained Bamfield, Mossback, and Leelanau soils reddish brown and brown. All three of these soils have a water table below a depth of 6 feet. Nearly level soils and soils in closed depressions are temporarily ponded and tend to have a water table close to the surface. The poorly drained Angelica soils are dominantly gray. These soils are subject to ponding and have a seasonal high water table at or above the surface. The moderately well drained Kent and Ossineke soils tend to be brown and have redoximorphic features (bright reds and yellows) in the subsoil. The somewhat poorly drained Slade soils tend to be grayish brown and have redoximorphic features in the subsoil. The grayish colors form when the iron in the soil is in a reduced state because of a lack of oxygen. In contrast, oxidized iron is bright red. The redoximorphic features form when part of the soil is saturated and thus has no oxygen and part is aerated. The wetter soils tend to have a darker surface layer because of an accumulation of organic matter.

In areas of outwash, the steeper soils are better drained than the nearly level soils. The influence of the porous, rapidly permeable parent material, however, can override the influence of topography. Because of rapid permeability, even the nearly level East Lake and Islandlake soils are somewhat excessively drained and brightly colored.

Some of the properties of the well drained soils that have a wide slope range vary according to the slope.

Two of these properties are depth to free carbonates and depth to the maximum clay percentage in the subsoil. These depths tend to decrease with an increase in slope. This decrease originally resulted from the amount of runoff versus deep percolation of warm-season precipitation, but it is now more closely related to the amount of soil lost through erosion.

Time

Time is needed for the various processes of the soil formation to take effect. The amount of time varies. A thin O horizon, such as the one in Ausable muck, may form in a fresh alluvial deposit in only a few years. Conversely, thousands of years are needed for the development of the genetic subsoil horizons in many of the older upland soils, such as the Bt horizon in Ossineke fine sandy loam. Fresh material is constantly being deposited on the alluvial soils. This material has not been in place long enough for the climate and vegetation to form well defined genetic horizons.

Processes of Soil Formation

Soil horizon differentiation is the result of four basic processes. These are additions, removals, transfers, and transformations. In most of the soils in Otsego County, two or more of these processes have been active in the development of horizons. Each of these processes affects many substances in the soil, such as organic matter, soluble salts, carbonates, sesquioxides, and silicate clay. The changes brought about by these various processes help to determine the kind soil profile that forms.

The accumulation of organic matter is an early phase in horizon development. It is affected by the age of the soil, its drainage, the vegetation it supports, and its productivity. The content of organic matter in the soils of Otsego County ranges from very low to very high. The organic matter content is very low in the thin A horizon in Grayling sand. This excessively drained soil is not very productive. Any organic matter in the soil is rapidly decomposed. The content of organic matter is high in Slade loam. This somewhat poorly drained soil is very productive. Its restricted drainage reduces the rate of organic matter decomposition.

Erosion can affect the rate of organic matter accumulation. There is a decrease where there is a loss of topsoil and an increase at the site of deposition.

The removal and translocation of substances from one part of the profile to another have differentiated horizons in most of the soils in the county. All factors being favorable, soluble minerals, salts, and carbonates are leached downward in the soils over time. The carbonates have been removed from the upper horizons of all the soils in the county. In some areas they have been deposited in the lower part of the soils and have become secondary accumulations of carbonates. After the carbonates are leached from the soils, the silicate clay particles can be translocated downward in solution. When most of the soluble minerals and clay particles have been leached from a layer in the soil, the layer becomes an eluviated, or E, horizon. Over time, the translocated clay typically accumulates as clay films in pores and on faces of peds, forming an illuviated, or Bt, horizon. Bamfield soils are an example of soils in which translocated silicate clay minerals in the form of clay films have accumulated in the B horizon.

Transformations can be physical or chemical. The weathering of soil particles to smaller sizes is a physical transformation. The reduction of iron from the ferric or oxidized state to the ferrous or reduced state is a chemical transformation. This process is called gleying. It can occur when the soil becomes saturated for long periods. The resulting lack of oxygen reduces the iron, and the soil becomes gray. This process has occurred in Cathro and other very poorly drained or poorly drained soils.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.
Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.
AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.
Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.
Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.
Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of tributary stream near or at its junction with its main stream.
Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.
Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.
Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.
Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.
Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.
Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.
Aspect. The direction in which a slope faces.
Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.
Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet per acre.
Basal till. Compact glacial till deposited beneath the ice.
Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.
Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.
Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.
Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.
Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or

cobbles. In some blowouts the water table is exposed.

Blowout (spot symbol). A general term for a small saucer- cup- or trough-shaped hollow or depression formed by wind erosion in an area of loose soil where productive vegetation is disturbed or does not occur. Less than 3 acres in size.

Board foot. A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board 1 foot wide, 1 foot long, and 1 inch thick before finishing.

Bogs (spot symbol). Waterlogged, spongy ground consisting primarily of acidic vegetation. These generally occur in small closed depressions within areas of mineral soils. Typically 1 to 3 acres in size.

Borrow pit (spot symbol). An open excavation from which soil and underlying material have been removed, generally for road construction. Less than 3 acres in size.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs (See Crown).

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (spot symbol). A spot where the surface layer is silty clay or clay. Less than 3 acres in size.

Clayey soil. Silty clay, sandy clay, or clay.

Clearcut. A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from adjacent stands.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Closed depressions. Low areas completely surrounded by higher ground and having no natural outlet.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (76 to 250 millimeters) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded

rock fragments 3 to 10 inches (76 to 250 millimeters) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Codominant trees. Trees that have crowns forming the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commerical forest. Forestland capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Congeliturbate. Soil material disturbed by frost action.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a “wire” when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cut and fill (spot symbol). Areas where native soil has been removed or buried. Less than 3 acres in size.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression (spot symbol). A shallow, saucer-shaped area lower on the landscape than the surrounding area and without a natural outlet for surface drainage. Less than 3 acres in size.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Disintegration moraine. A drift topography characterized by chaotic mounds and pits, generally randomly oriented, developed in supraglacial drift by collapse and flow as the underlying stagnant ice melted. Slopes may be steep and unstable, and there are used and unused stream courses and lake depressions interspersed with moranic ridges. Consequently, there are rapid or abrupt changes between materials of differing lithology.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Dominent trees. Trees that have crowns forming the general level of the forest canopy and that receive full light from above and from the sides.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground that is at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or not have distinctly incised channels at its upper reaches or throughout its course.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Drumlin. A low, smooth, elongated, oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus

Dump (spot symbol). An area of accumulated waste products of human habitation which can be above

or below natural ground level. Typically 1 to 3 acres in size.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

End moraine. A ridgelike accumulation that is being or was produced at the outer margin of an actively flowing glacier at any given time

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent materials accumulated though wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion pavement. A layer of gravel or stones that remain on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Escarpment, other than bedrock (spot symbol). A relatively continuous and steep slope or cliff produced when erosion or faulting breaks the general continuity of more gently sloping land surfaces. The exposed material that is not bedrock is nonsoil or a very shallow, poorly developed soil.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Even aged. Refers to a stand of trees in which only small differences in age occur between the individuals. A range of 20 years is allowed.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. A firebreak also serves as a line from which to work and to facilitate the movement of fire fighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flat. A general term for a level or nearly level surface, or small area of land marked by little or no relief.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Footslope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and

biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solemn, or true soil, from the unconsolidated parent material.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciated uplands. Land areas that were previously covered by continental or alpine glaciers and that are at a higher elevation than the flood plain.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (spot symbol). An area where gravel is being excavated. Less than 3 acres in size.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (spot symbol). A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter. Less than 3 acres in size.

Gravelly strata (spot symbol). Areas that have strata of gravel in the subsoil. Typically 1 to 3 acres in size.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground moraine. An extensive, fairly even layer of till, having an uneven or undulating surface; a deposit of rock and mineral debris dragged along, in, or beneath a glacier and emplaced by processes including basal lodgment and release from downwasting stagnant ice by ablation.

Ground water. Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation

of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Kame terrace. A terracelike ridge consisting of stratified sand and gravel that where deposited by

a meltwater stream flowing between a melting glacier and a higher valley wall or lateral moraine and that remained after the disappearance of the ice. It is commonly pitted with kettles and has an irregular ice-contact slope.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain (geology). A nearly level surface marking the floor of an extinct lake filled in by well sorted, coarse textured to fine textured, stratified sediments.

Lammela A thin discontinuous or continuous, generally horizontal layer of fine textured material that has been pedogenically concentrated within a coarser eluviated layer.

Landfill (spot symbol). An area of accumulated waste products of human habitation. Less than 3 acres in size.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (76 millimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loam at depth (spot symbol). Areas where loamy material is at a depth of 20 to 40 inches in sandy soils. Less than 3 acres in size.

Loamy soils. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loamy spot (spot symbol). An area of loamy material at the surface in sandy areas. Less than 3 acres in size.

Lobe. A tonguelike projection from the main mass of a continental glacier.

Low strength. The soil is not strong enough to support loads.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Marl spot (spot symbol). An area of marl less than 3 acres in size.

Marsh. Periodically wet or continually flooded areas where the surface is not deeply submerged. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants.

Marsh spot (spot symbol). A water-saturated, very poorly drained area, intermittently or permanently covered with water, having aquatic and grasslike vegetation, and essentially without the formation of peat. Less than 3 acres in size.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mean annual increment (MAI). The average annual increase in volume of a tree during the entire life of the tree.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees. Trees that are of sufficient size to be economically processed into wood products

Mineral in muck (spot symbol). An area of mineral soils in an organic area. Less than 3 acres in size.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. A soil that is 20 to 40 inches deep to bedrock or to other material that restricts the penetration of plant roots.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation

and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat. Organic soil material intermediate in degree of decomposition between the less decomposed peat and the more decomposed muck.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. The depth to which roots have been observed to penetrate.

Organic mat. A zone of accumulation of organic matter, such as leaves, twigs, and grasses in various stages of decomposition, that lies above the mineral soil. Often described in forested regions and commonly called a duff layer.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Organic spot (spot symbol). A nonacid area of organic soil more than 9 inches thick and surrounded by mineral surface material. Less than 3 acres in size.

Ortstein. A hardened mass or layer in the soil in which the cementing material consists of illuviated compounds of iron and aluminum and organic matter.

Outwash. Stratified detritus removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the end moraine or margin of an active glacier. The coarser textured material is deposited nearer to the ice.

Outwash channel. A long, narrow body of outwash confined within a valley beyond a glacier; it may or may not emerge from the valley and join an outwash plain.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Overstory. The trees in the forest that form the upper crown cover.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Perennial water (spot symbol). Small natural or manmade lake, pond, or pit that contains water most of the year. Typically 1 to 3 acres in size.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pit, gravel (spot symbol). An area where gravel is being excavated. Less than 3 acres in size.

Pitted outwash. Outwash with pits or kettles, produced by the partial or complete burial of glacial ice by outwash and the subsequent thaw of the ice and collapse of the surfacial materials.

Pitting (in tables). The formation of pits caused by melting around ice. The pits form after the plant cover is removed.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proglacial lake. A type of glacial lake that formed just beyond the margin of an advancing or retreating glacier, generally in direct contact with the ice.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Ravine. A small stream channel that is narrow, steep sided, commonly V-shaped in cross section, and larger than a gully.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Recessional moraine. A moraine formed during a temporary but significant halt in the retreat of a glacier.

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regeneration. The new growth of a natural plant community, developing from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Remnant moraine. A moraine that was deposited during an older glacial period and remains after subsequent glacial advances.

Renitent angle. The angle formed at the intersection of two lobes of a continental glacier.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Ridge. A long, narrow elevation of the land surface, generally sharp crested with steep sides and forming an extended upland between valleys.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandy soils. Sand or loamy sand.

Sandy spot (spot symbol). The surface layer is sandy in an area that is dominantly loamy or finer textured. Less than 3 acres in size.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Sawlogs. Logs of suitable size and quality for the production of lumber.

Scarification. The act of abrading, scratching, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (spot symbol). An area where, on the average, 75 percent or more of the original surface layer has been lost to accelerated erosion. Less than 3 acres in size.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shelterwood system. A forest management system requiring the removal of a stand in a series of cuts so that regeneration occurs under a partial canopy. After regeneration, a final cut removes the shelterwood and allows the stand to develop in the open as an even-aged stand. The system is well suited to sites where shelter is needed for regeneration, and it can aid in the regeneration of the more intolerant tree species in a stand.

Short steep slope (spot symbol). A narrow soil area with a slope of 8 to 18 percent. Soils above and below are nearly level to gently sloping.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Sinkhole (spot symbol). A closed depression formed either by solution of the surfical rock or collapse of underlying caves. Complexes of sinkholes in carbonate-rock terrain are the main component of karst topography. Less than 3 acres in size.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading unto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 3 percent
Gently sloping	2 to 6 percent
Moderately sloping	6 to 12 percent
Strongly sloping	12 to 18 percent
Moderately steep	18 to 25 percent
Steep	25 to 35 percent
Very steep	35 percent and higher

Classes for complex slopes are as follows:

Nearly level	0 to 3 percent
Undulating	2 to 6 percent
Gently rolling	6 to 12 percent
Rolling	12 to 18 percent
Hilly	18 to 25 percent
Steep	25 to 35 percent
Very steep	35 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth’s surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation

are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Spring (spot symbol). A specific site where ground water flows from the surface for at least 6 months of the year.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (spot symbol). An area where stones cover 0.1 to 3 percent of the surface and where the surrounding soil is nonstony. Less than 3 acres in size.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel. It originally formed near the level of the stream and is the dissected remnant of an abandoned flood plain, streambed, or valley floor produced during a former stage of erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summit. The topographically highest hillslope position of a hillslope profile and exhibiting a nearly level surface.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

Taxadjucts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be

farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The outermost inclined surface at the base of a hill; part of a footslope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to top dress road banks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic throughout a wide range in soil moisture conditions

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Unstable fill (in tables). Fill material that is subject to caving or sloughing.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Valley fill. In glaciated regions material deposited in stream valleys by glacial meltwater. In nonglaciated regions alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (spot symbol). An area where stones cover more than 3 percent of the surface and where the surrounding soil is nonstony. Less than 3 acres in size.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if they are constructed properly.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (spot symbol). A somewhat poorly drained to very poorly drained spot that is at least two drainage classes wetter than the named soils in the surrounding map unit. Less than 3 acres in size.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven dry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-1990 at Gaylord, Michigan)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	*°F*	*°F*	*°F*	*°F*	*Units*	*In*	*In*	*In*		*In*
January-----	25.4	9.4	17.4	46	-23	0	2.65	1.70	3.52	8	38.1
February----	28.4	8.9	18.7	50	-22	0	1.81	1.05	2.49	5	23.2
March-------	39.0	18.2	28.6	65	-16	3	2.32	1.38	3.15	6	18.6
April-------	53.8	30.5	42.2	82	6	46	2.38	1.48	3.19	6	7.0
May---------	67.7	40.9	54.3	88	22	197	2.99	1.60	4.21	6	1.0
June--------	76.2	50.0	63.1	92	30	397	2.87	1.68	3.94	6	0.0
July--------	80.9	55.2	68.0	94	37	557	2.96	1.50	4.23	5	0.0
August------	77.5	53.5	65.5	92	34	480	3.60	1.94	5.06	7	0.0
September---	68.9	46.7	57.8	86	26	258	4.20	2.10	6.03	9	0.0
October-----	57.2	37.3	47.3	79	17	83	3.33	2.09	4.45	8	3.1
November----	42.2	27.3	34.7	68	3	7	3.44	2.24	4.53	9	22.9
December----	29.4	15.5	22.5	53	-14	0	3.07	2.21	3.88	9	36.0
Yearly:											
Average---	53.9	32.8	43.3	---	---	---	---	---	---	---	---
Extreme---	97	-37	---	95	-26	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,028	35.62	28.51	40.15	84	149.91

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-1990 at Gaylord, Michigan)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than-----	May 16	May 29	June 15
2 years in 10 later than-----	May 10	May 24	June 9
5 years in 10 later than-----	April 28	May 13	May 28
First freezing temperature in fall:			
1 year in 10 earlier than---	September 29	September 17	August 30
2 years in 10 earlier than---	October 6	September 24	September 5
5 years in 10 earlier than---	October 19	October 7	September 18

Table 3.--Growing Season

(Recorded in the period 1961-1990 at Gaylord, Michigan)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	*Days*	*Days*
9 years in 10	145	117	82
8 years in 10	154	127	92
5 years in 10	171	146	112
2 years in 10	188	165	131
1 year in 10	196	174	141

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
13	Tawas-Lupton mucks	22,304	6.6
14	Dawson-Loxley peats	1,737	0.5
15A	Croswell-Au Gres sands, 0 to 3 percent slopes	1,881	0.6
16B	Graycalm sand, 0 to 6 percent slopes	6,004	1.8
17A	Croswell sand, 0 to 3 percent slopes	2,945	0.9
17B	Croswell sand, 0 to 6 percent slopes	1,071	0.3
18A	Au Gres sand, 0 to 3 percent slopes	891	0.3
19	Leafriver muck	441	0.1
20B	Graycalm-Grayling sands, 0 to 6 percent slopes	3,308	1.0
20D	Graycalm-Grayling sands, 6 to 18 percent slopes	718	0.2
20F	Graycalm-Grayling sands, 18 to 45 percent slopes	880	0.3
23	Ausable-Bowstring mucks, frequently flooded	2,793	0.8
24A	Kinross-Au Gres complex, 0 to 3 percent slopes	101	*
25B	Kent sandy loam, 2 to 6 percent slopes	223	*
25C	Kent sandy loam, 6 to 12 percent slopes	241	*
28B	East Lake sand, 0 to 6 percent slopes	1,136	0.3
28C	East Lake sand, 6 to 12 percent slopes	481	0.1
28E	East Lake sand, 12 to 35 percent slopes	803	0.2
32B	Kellogg sand, 0 to 6 percent slopes	475	0.1
33B	Mancelona loamy sand, 0 to 6 percent slopes	9,252	2.7
33C	Mancelona loamy sand, 6 to 12 percent slopes	1,972	0.6
33D	Mancelona loamy sand, 12 to 18 percent slopes	1,173	0.3
33E	Mancelona loamy sand, 18 to 35 percent slopes	2,589	0.8
47D	Graycalm sand, 6 to 18 percent slopes	3,017	0.9
47F	Graycalm sand, 18 to 45 percent slopes	896	0.3
49B	Kalkaska sand, 0 to 6 percent slopes	14,527	4.3
50B	Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes	130	*
51	Tawas-Leafriver mucks	2,781	0.8
52B	Blue Lake loamy sand, 0 to 6 percent slopes	21,379	6.3
52D	Blue Lake loamy sand, 6 to 18 percent slopes	16,945	5.0
52E	Blue Lake loamy sand, 18 to 35 percent slopes	2,462	0.7
64B	Feldhauser fine sandy loam, 0 to 6 percent slopes	1,643	0.5
65F	Rubicon sand, 8 to 50 percent slopes, dissected	2,107	0.6
75B	Rubicon sand, 0 to 6 percent slopes	40,236	11.9
75D	Rubicon sand, 6 to 18 percent slopes	7,302	2.2
75E	Rubicon sand, 18 to 35 percent slopes	1,463	0.4
78	Pits, borrow	839	0.2
81B	Grayling sand, 0 to 6 percent slopes	4,067	1.2
81D	Grayling sand, 6 to 18 percent slopes	1,223	0.4
81E	Grayling sand, 18 to 35 percent slopes	15	*
81F	Grayling sand, 18 to 45 percent slopes	538	0.2
82B	Udorthents, loamy, nearly level and undulating	48	*
83B	Udipsamments, nearly level and undulating	180	*
86	Histosols and Aquents, ponded	1,031	0.3
90B	Chinwhisker sand, 0 to 4 percent slopes	515	0.2
95D	Menominee loamy sand, 12 to 18 percent slopes	1,030	0.3
95E	Menominee loamy sand, 18 to 35 percent slopes	615	0.2
113	Angelica loam	304	*
115D	Kalkaska sand, 6 to 18 percent slopes	6,112	1.8
116B	Mancelona sand, 0 to 6 percent slopes	88	*
126F	Udipsamments-Haplorthods-Glossudalfs complex, nearly level to steep	922	0.3
127	Cathro muck	314	*
141B	Leelanau loamy sand, 0 to 6 percent slopes	4,836	1.4
141C	Leelanau loamy sand, 6 to 12 percent slopes	5,986	1.8
141D	Leelanau loamy sand, 12 to 18 percent slopes	1,433	0.4
146F	Rubicon-Graycalm sands, 8 to 50 percent slopes, dissected	298	*
147B	Lindquist sand, 0 to 6 percent slopes	21,741	6.5
147C	Lindquist sand, 6 to 12 percent slopes	3,074	0.9
147D	Lindquist sand, 12 to 18 percent slopes	2,695	0.8
147E	Lindquist sand, 18 to 35 percent slopes	1,210	0.4
166A	Slade loam, 0 to 3 percent slopes	250	*

See footnote at end of table.

Table 4.--Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
197A	Gladwin loamy sand, 0 to 3 percent slopes	472	0.1
323B	East Lake-Rubicon sands, 0 to 6 percent slopes	1,609	0.5
323C	East Lake-Rubicon sands, 6 to 12 percent slopes	419	0.1
337B	Mancelona-East Lake complex, 0 to 6 percent slopes	496	0.1
337C	Mancelona-East Lake complex, 6 to 12 percent slopes	113	*
338B	Islandlake sand, 0 to 6 percent slopes	4,428	1.3
338C	Islandlake sand, 6 to 12 percent slopes	1,003	0.3
338D	Islandlake sand, 12 to 18 percent slopes	172	*
347F	Kalkaska sand, 8 to 50 percent slopes, dissected	12,751	3.8
349B	Hartwick sand, 0 to 6 percent slopes	925	0.3
350D	Blue Lake sand, 6 to 18 percent slopes	20	*
352B	Deford-Au Gres-Croswell complex, 0 to 6 percent slopes	537	0.2
354F	Mancelona-Blue Lake sands, 15 to 70 percent slopes, dissected	1,260	0.4
360	Wakeley muck	159	*
362D	Millersburg loamy sand, 6 to 18 percent slopes	24	*
365F	Blue Lake loamy sand, 8 to 50 percent slopes, dissected	11,845	3.5
368A	Au Gres-Deford complex, 0 to 3 percent slopes	836	0.2
369	Deford muck	809	0.2
380	Access denied	4,032	1.2
387F	Mancelona-Rubicon sands, 15 to 70 percent slopes, dissected	24	*
393B	Morganlake loamy sand, 0 to 6 percent slopes	3,754	1.1
393C	Morganlake loamy sand, 6 to 12 percent slopes	1,999	0.6
399D	Menominee-Bamfield, sandy substratum-Blue Lake complex, 12 to 18 percent slopes	1,968	0.6
400F	Menominee-Bamfield, sandy substratum-Blue Lake complex, 15 to 70 percent slopes, dissected	2,764	0.8
401F	Lindquist sand, 8 to 50 percent slopes, dissected	2,383	0.7
402B	Islandlake loamy sand, 0 to 6 percent slopes	5,757	1.7
402C	Islandlake loamy sand, 6 to 12 percent slopes	650	0.2
402D	Islandlake loamy sand, 12 to 18 percent slopes	91	*
424B	Morganlake-Ossineke, sandy substratum-Blue Lake complex, 0 to 6 percent slopes	1,628	0.5
424C	Morganlake-Ossineke, sandy substratum-Blue Lake complex, 6 to 12 percent slopes	1,304	0.4
452D	Bamfield fine sandy loam, sandy substratum, 12 to 18 percent slopes	1,544	0.5
452E	Bamfield fine sandy loam, sandy substratum, 18 to 35 percent slopes	241	*
453B	Ossineke fine sandy loam, sandy substratum, 0 to 6 percent slopes	6,384	1.9
453C	Ossineke fine sandy loam, sandy substratum, 6 to 12 percent slopes	2,013	0.6
463F	Leelanau loamy sand, 8 to 50 percent slopes, dissected	2,207	0.7
464B	Mossback sandy loam, 0 to 6 percent slopes	6,782	2.0
464C	Mossback sandy loam, 6 to 12 percent slopes	4,446	1.3
464D	Mossback sandy loam, 12 to 18 percent slopes	2,279	0.7
464E	Mossback sandy loam, 18 to 35 percent slopes	1,297	0.4
465	Caffey muck	142	*
W	Water	7,501	2.2
	Total	336,749	100.0

* Less than 0.1 percent.

Table 5.--Land Capability and Yields per Acre of Crops

(Yields are for nonirrigated areas. They are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil.)

Map symbol	Land capability	Corn	Corn silage	Oats	Winter wheat
		Bu	*Tons*	*Bu*	*Bu*
24A:					
Kinross	6w	---	---	---	---
Au Gres	4w	55	10.0	45	25
25B:					
Kent	3e	75	12.0	70	32
25C:					
Kent	4e	70	10.5	65	30
28B:					
East Lake	4s	50	9.0	40	---
32B:					
Kellogg	3s	70	10.5	30	35
33B:					
Mancelona	3s	60	10.0	28	28
33C:					
Mancelona	3e	55	9.5	25	24
33D:					
Mancelona	4e	---	---	20	20
49B:					
Kalkaska	4s	50	9.0	25	25
52B:					
Blue Lake	3s	65	10.5	40	28
52D:					
Blue Lake	4e	55	9.0	35	22
64B:					
Feldhauser	2e	75	12.0	35	35
95E:					
Menominee	6e	---	---	55	23
116B:					
Mancelona	3s	50	9.0	25	28
141B:					
Leelanau	3s	65	11.0	30	30
141C:					
Leelanau	3e	55	8.0	25	25
147B:					
Lindquist	4s	50	9.0	25	25
166A:					
Slade	2w	80	12.0	32	32

Table 5.--Land Capability and Yields per Acre of Crops--Continued

Map symbol	Land capa- bility	Corn	Corn silage	Oats	Winter wheat
		Bu	*Tons*	*Bu*	*Bu*
197A:					
Gladwin------------	3w	60	10.0	30	35
323B:					
East Lake----------	4s	50	9.0	40	---
Rubicon------------	6s	---	---	---	---
337B:					
Mancelona----------	3s	65	10.5	40	28
East Lake----------	4s	---	---	---	---
337C:					
Mancelona----------	3e	55	7.0	35	22
East Lake----------	6s	---	---	---	---
338B:					
Islandlake---------	4s	50	9.0	25	25
350D:					
Blue Lake----------	4e	60	9.0	50	22
393B:					
Morganlake---------	3s	65	11.0	35	35
393C:					
Morganlake---------	3e	55	9.0	20	30
402B:					
Islandlake---------	4s	65	10.5	35	28
402C:					
Islandlake---------	6s	55	9.0	30	22
424B:					
Morganlake---------	3s	65	11.0	35	35
Ossineke-----------	3e	80	13.0	75	---
Blue Lake----------	3s	65	10.5	40	28
424C:					
Morganlake---------	3e	55	9.0	30	30
Ossineke-----------	3e	80	13.0	75	---
Blue Lake----------	3e	65	10.5	40	28
453B:					
Ossineke-----------	3e	85	12.5	35	40
453C:					
Ossineke-----------	3e	85	12.0	30	35
464B:					
Mossback-----------	2e	75	12.0	35	40
464C:					
Mossback-----------	3e	60	10.5	30	35

Table 6.--Land Capability and Yields per Acre of Hay and Pasture

(Yields are for nonirrigated areas. They are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to hay or that hay generally is not grown on the soil.)

Map symbol and soil name	Land capability	Alfalfa hay	Bromegrass-alfalfa hay	Grass-clover	Pasture
		Tons	*Tons*	*Tons*	*AUM**
15A:					
Croswell-----------	4s	2.0	---	1.5	0.6
Au Gres------------	4w	2.0	1.8	1.5	0.6
16B:					
Graycalm-----------	4s	1.8	---	1.3	0.5
17A:					
Croswell-----------	4s	2.0	---	1.5	0.6
17B:					
Croswell-----------	4s	2.0	---	1.5	0.6
18A:					
Au Gres------------	4w	2.0	1.8	1.5	0.6
24A:					
Kinross------------	6w	---	---	---	---
Au Gres------------	4w	---	1.8	---	---
25B:					
Kent---------------	3e	3.5	---	3.0	1.0
25C:					
Kent---------------	4e	3.3	---	2.5	0.9
28B:					
East Lake----------	4s	2.5	---	1.8	0.7
28C:					
East Lake----------	6s	2.3	---	1.6	0.7
32B:					
Kellogg------------	3s	3.0	---	2.8	0.9
33B:					
Mancelona----------	3s	3.0	---	2.1	0.9
33C:					
Mancelona----------	3e	2.8	---	2.0	0.8
33D:					
Mancelona----------	4e	2.6	---	1.9	0.7
47D:					
Graycalm-----------	6s	1.6	---	1.1	0.5
49B:					
Kalkaska-----------	4s	2.5	1.8	1.8	0.5
52B:					
Blue Lake----------	3s	2.8	2.8	2.0	0.8

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa hay	Bromegrass-alfalfa hay	Grass-clover	Pasture
		Tons	*Tons*	*Tons*	*AUM**
52D:					
Blue Lake----------	4e	2.0	2.0	1.8	0.6
64B:					
Feldhauser---------	2e	3.5	---	2.8	1.0
75B:					
Rubicon------------	6s	2.0	---	1.4	0.5
75D:					
Rubicon------------	7s	1.8	---	1.2	0.4
95D:					
Menominee----------	4e	2.6	---	2.4	0.7
95E:					
Menominee----------	6e	3.1	---	---	---
115D:					
Kalkaska-----------	6s	1.6	---	1.2	0.5
116B:					
Mancelona----------	3s	2.5	---	2.0	0.9
141B:					
Leelanau-----------	3s	3.0	---	2.4	0.8
141C:					
Leelanau-----------	3e	2.8	---	2.4	0.7
141D:					
Leelanau-----------	4e	2.0	---	2.0	0.6
147B:					
Lindquist----------	4s	2.4	---	2.0	0.7
147C:					
Lindquist----------	6s	2.3	---	1.6	0.7
147D:					
Lindquist----------	6s	2.0	---	1.2	0.6
166A:					
Slade--------------	2w	3.5	---	3.0	1.0
197A:					
Gladwin------------	3w	3.3	---	2.5	0.9
323B:					
East Lake----------	4s	2.3	---	1.6	0.7
Rubicon------------	6s	---	---	---	---
323C:					
East Lake----------	6s	2.2	---	1.4	0.6
Rubicon------------	6s	---	---	---	---

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa hay	Bromegrass-alfalfa hay	Grass-clover	Pasture
		Tons	*Tons*	*Tons*	*AUM**
337B:					
Mancelona	3s	3.2	---	2.0	0.9
East Lake	4s	---	---	---	---
337C:					
Mancelona	3e	3.0	---	1.9	0.8
East Lake	6s	---	---	---	---
338B:					
Islandlake	4s	2.4	---	2.0	0.7
338C:					
Islandlake	6s	2.0	---	1.7	0.6
338D:					
Islandlake	7s	1.8	---	1.5	0.5
349B:					
Hartwick	6s	1.6	---	1.4	0.4
350D:					
Blue Lake	4e	2.2	2.2	1.8	0.6
362D:					
Millersburg	4e	2.2	---	2.0	0.6
393B:					
Morganlake	3s	3.0	---	2.6	0.9
393C:					
Morganlake	3e	2.8	---	2.4	0.8
399D:					
Menominee	4e	2.6	---	2.4	0.8
Bamfield	4e	---	---	---	---
Blue Lake	4e	---	---	---	---
402B:					
Islandlake	4s	2.7	---	2.0	0.8
402C:					
Islandlake	6s	2.5	---	1.9	0.7
402D:					
Islandlake	7s	2.3	---	1.8	0.7
424B:					
Morganlake	3s	3.0	---	2.6	0.9
Ossineke	3e	---	---	---	---
Blue Lake	3s	---	---	---	---

See footnote at end of table.

Table 6.--Land Capability and Yields per Acre of Hay and Pasture--Continued

Map symbol and soil name	Land capability	Alfalfa hay	Bromegrass-alfalfa hay	Grass-clover	Pasture
		Tons	*Tons*	*Tons*	*AUM**
424C:					
Morganlake	3e	2.8	---	2.4	0.8
Ossineke	3e	3.5	---	---	---
Blue Lake	3e	---	---	---	---
452D:					
Bamfield	4e	3.1	---	2.7	0.9
453B:					
Ossineke	3e	3.5	---	3.0	1.0
453C:					
Ossineke	3e	3.3	---	2.5	0.9
464B:					
Mossback	2e	3.5	3.5	2.8	1.0
464C:					
Mossback	3e	3.5	3.5	2.8	1.0
464D:					
Mossback	4e	3.0	---	2.4	0.9

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Table 7.--Land Capability and Yields per Acre of Specialty Crops

(Yields in the "N" columns are for nonirrigated areas; those in the "I" column are for irrigated areas. The yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or that the crop generally is not grown on the soil.)

Map symbol and soil name	Land capability	Dry beans	Spring canola	Irish potatoes		Soybeans	Sunflowers
	N	N	N	N	I	N	N
		Cwt	*Cwt*	*Cwt*	*Cwt*	*Bu*	*Cwt*
15A:							
Croswell-----------	4s	---	---	120	300	---	---
Au Gres------------	4w	---	---	120	300	---	---
17A:							
Croswell-----------	4s	---	---	120	300	---	---
17B:							
Croswell-----------	4s	---	---	120	300	---	---
18A:							
Au Gres------------	4w	---	---	120	300	---	---
25B:							
Kent---------------	3e	25	35	150	285	20	25
25C:							
Kent---------------	4e	23	33	150	0	18	23
28B:							
East Lake----------	4s	---	---	125	300	---	---
32B:							
Kellogg------------	3s	20	---	---	---	---	20
33B:							
Mancelona----------	3s	---	---	150	340	---	20
33C:							
Mancelona----------	3e	---	---	145	---	---	18
49B:							
Kalkaska-----------	4s	---	---	120	300	---	---
52B:							
Blue Lake----------	3s	---	---	125	---	---	18
64B:							
Feldhauser---------	2e	23	30	180	390	20	25
75B:							
Rubicon------------	6s	---	---	120	285	---	---
116B:							
Mancelona----------	3s	18	---	120	300	---	18
141B:							
Leelanau-----------	3s	---	---	160	390	---	20
141C:							
Leelanau-----------	3e	---	---	160	---	---	20
147B:							
Lindquist----------	4s	---	---	125	300	---	---

Table 7.--Land Capability and Yields per Acre of Specialty Crops--Continued

Map symbol and soil name	Land capability	Dry beans	Spring canola	Irish potatoes		Soybeans	Sunflowers
	N	N	N	N	I	N	N
		Cwt	*Cwt*	*Cwt*	*Cwt*	*Bu*	*Cwt*
166A:							
Slade	2w	25	35	260	370	30	30
197A:							
Gladwin	3w	20	30	135	300	23	25
323B:							
East Lake	4s	---	---	125	300	---	---
Rubicon	6s	---	---	---	---	---	---
337B:							
Mancelona	3s	---	---	150	340	---	---
East Lake	4s	---	---	---	---	---	---
338B:							
Islandlake	4s	---	---	125	300	---	---
393B:							
Morganlake	3s	20	---	165	340	---	22
393C:							
Morganlake	3e	18	---	165	---	---	20
402B:							
Islandlake	4s	---	---	150	350	---	20
402C:							
Islandlake	6s	---	---	145	---	---	18
424B:							
Morganlake	3s	20	---	260	370	---	22
Ossineke	3e	---	---	---	---	---	---
Blue Lake	3s	---	---	---	---	---	---
424C:							
Morganlake	3e	18	---	225	---	---	20
Ossineke	3e	---	---	---	---	---	---
Blue Lake	3e	---	---	---	---	---	---
453B:							
Ossineke	3e	25	35	260	370	20	30
453C:							
Ossineke	3e	23	33	225	---	18	28
464B:							
Mossback	2e	23	30	260	370	18	25
464C:							
Mossback	3e	21	28	225	---	16	23

Table 8.--Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name.)

Map symbol	Soil name
25B	Kent sandy loam, 2 to 6 percent slopes
64B	Feldhauser fine sandy loam, 0 to 6 percent slopes
113	Angelica loam (where drained)
166A	Slade loam, 0 to 3 percent slopes (where drained)
453B	Ossineke fine sandy loam, sandy substratum, 0 to 6 percent slopes
464B	Mossback sandy loam, 0 to 6 percent slopes

Table 9.--Forestland Management and Productivity

(Only the soils suitable for the production of commercial trees are listed.)

Map symbol and soil name	Ordination symbol	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
13:										
Tawas----------	5W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	40	72	---
							Black ash-----------	---	---	
							Black spruce--------	20	29	
							Eastern hemlock-----	---	---	
							Northern whitecedar	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red maple-----------	---	---	
							Tamarack------------	---	---	
							Yellow birch--------	---	---	
Lupton---------	2W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	46	86	---
							Black ash-----------	---	---	
							Black spruce--------	20	29	
							Eastern hemlock-----	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red maple-----------	---	---	
							Tamarack------------	---	---	
							Yellow birch--------	---	---	
14:										
Dawson---------	2W	Slight	Severe	Severe	Severe	Severe	Black spruce--------	15	29	---
							Eastern white pine--	---	---	
							Red pine------------	---	---	
							Tamarack------------	---	---	
Loxley---------	2W	Slight	Severe	Severe	Severe	Severe	Black spruce--------	15	29	---
							Eastern white pine--	---	---	
							Red pine------------	---	---	
							Tamarack------------	---	---	
15A:										
Croswell-------	5S	Slight	Moderate	Moderate	Moderate	Moderate	Balsam fir----------	---	---	Eastern white
							Eastern white pine--	---	---	pine, northern
							Jack pine-----------	53	72	red oak, red
							Northern red oak----	---	---	maple, red
							Quaking aspen-------	68	72	pine, white
							Red maple-----------	---	---	spruce.
							Red pine------------	55	86	
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Severe	Balsam fir----------	---	---	Norway spruce,
							Black ash-----------	---	---	black ash,
							Black spruce--------	---	---	eastern white
							Eastern white pine--	---	---	pine, red
							Northern whitecedar	---	---	maple, red
							Paper birch---------	---	---	pine, white
							Quaking aspen-------	70	86	spruce.
							Red maple-----------	65	43	
							Red pine------------	---	---	
							Yellow birch--------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
16B:										
Graycalm	6S	Slight	Moderate	Moderate	Slight	Slight	Bigtooth aspen	70	86	Eastern white pine, northern red oak, red pine.
							Black cherry	---	---	
							Eastern white pine	---	---	
							Jack pine	56	86	
							Northern pin oak	---	---	
							Northern red oak	62	57	
							Quaking aspen	60	57	
							Red maple	---	---	
							Red pine	61	100	
17A:										
Croswell	5S	Slight	Moderate	Moderate	Moderate	Moderate	Balsam fir	---	---	Eastern white pine, northern red oak, red maple, red pine, white spruce.
							Eastern white pine	---	---	
							Jack pine	53	72	
							Northern red oak	---	---	
							Quaking aspen	68	72	
							Red maple	---	---	
							Red pine	55	86	
17B:										
Croswell	5S	Slight	Moderate	Moderate	Moderate	Moderate	Balsam fir	---	---	Eastern white pine, northern red oak, red maple, red pine, white spruce.
							Eastern white pine	---	---	
							Jack pine	53	72	
							Northern red oak	---	---	
							Quaking aspen	68	72	
							Red maple	---	---	
							Red pine	55	86	
18A:										
Au Gres	6W	Slight	Severe	Moderate	Severe	Severe	Balsam fir	---	---	Norway spruce, black ash, eastern white pine, red maple, red pine, white spruce.
							Black ash	---	---	
							Black spruce	---	---	
							Eastern white pine	---	---	
							Northern whitecedar	---	---	
							Paper birch	---	---	
							Quaking aspen	70	86	
							Red maple	65	43	
							Red pine	---	---	
							Yellow birch	---	---	
19:										
Leafriver	2W	Slight	Severe	Severe	Severe	Severe	Balsam fir	---	---	---
							Black spruce	---	---	
							Eastern white pine	---	---	
							Northern whitecedar	---	---	
							Quaking aspen	45	29	
							Red maple	---	---	
							Tamarack	---	---	
20B:										
Graycalm	6S	Slight	Moderate	Moderate	Slight	Slight	Bigtooth aspen	70	86	Eastern white pine, northern red oak, red pine.
							Black cherry	---	---	
							Eastern white pine	---	---	
							Jack pine	56	86	
							Northern pin oak	---	---	
							Northern red oak	62	57	
							Quaking aspen	60	57	
							Red maple	---	---	
							Red pine	61	100	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
20B:										
Grayling-------	4S	Slight	Moderate	Moderate	Slight	Slight	Jack pine-----------	48	57	Jack pine, red pine.
							Northern pin oak----	43	29	
							Northern red oak----	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
20D:										
Graycalm-------	6S	Slight	Moderate	Moderate	Slight	Slight	Bigtooth aspen------	70	86	Eastern white pine, northern red oak, red pine.
							Black cherry--------	---	---	
							Eastern white pine--	---	---	
							Jack pine-----------	56	86	
							Northern pin oak----	---	---	
							Northern red oak----	62	57	
							Quaking aspen-------	60	57	
							Red maple-----------	---	---	
							Red pine------------	61	100	
Grayling-------	4S	Slight	Moderate	Moderate	Slight	Slight	Jack pine-----------	48	57	Jack pine, red pine.
							Northern pin oak----	43	29	
							Northern red oak----	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
20F:										
Graycalm-------	6R	Moderate	Moderate	Moderate	Slight	Slight	Bigtooth aspen------	70	86	Eastern white pine, northern red oak, red pine.
							Black cherry--------	---	---	
							Eastern white pine--	---	---	
							Jack pine-----------	56	86	
							Northern pin oak----	---	---	
							Northern red oak----	62	57	
							Quaking aspen-------	60	57	
							Red maple-----------	---	---	
							Red pine------------	61	100	
Grayling-------	4R	Moderate	Moderate	Moderate	Slight	Slight	Jack pine-----------	48	57	Jack pine, red pine.
							Northern pin oak----	43	29	
							Northern red oak----	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
23:										
Ausable--------	2W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	---
							Black spruce--------	---	---	
							Eastern hemlock-----	---	---	
							Northern whitecedar	15	29	
							Paper birch---------	---	---	
Bowstring------	3W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	---
							Black spruce--------	---	---	
							Eastern hemlock-----	---	---	
							Northern whitecedar	15	43	
							Paper birch---------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
24A:										
Kinross--------	2W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	---
							Black spruce--------	---	---	
							Eastern white pine--	---	---	
							Jack pine-----------	---	---	
							Northern whitecedar	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	45	29	
							Red maple-----------	---	---	
							Tamarack------------	---	---	
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Severe	Balsam fir----------	---	---	Norway spruce, black ash, eastern white pine, red maple, red pine, white spruce.
							Black ash-----------	---	---	
							Black spruce--------	---	---	
							Eastern white pine--	---	---	
							Northern whitecedar	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	70	86	
							Red maple-----------	65	43	
							Red pine------------	---	---	
							Yellow birch--------	---	---	
25B:										
Kent-----------	7C	Slight	Severe	Slight	Moderate	Moderate	American basswood---	55	43	Eastern white pine, sugar maple, white spruce.
							American beech------	---	---	
							American elm--------	---	---	
							Balsam fir----------	54	100	
							Eastern hemlock-----	---	---	
							Eastern white pine--	---	---	
							Paper birch---------	63	72	
							Quaking aspen-------	---	---	
							Sugar maple---------	---	---	
							White spruce--------	54	100	
25C:										
Kent-----------	7C	Slight	Severe	Slight	Moderate	Moderate	American basswood---	55	43	Eastern white pine, sugar maple, white spruce.
							American beech------	---	---	
							American elm--------	---	---	
							Balsam fir----------	54	100	
							Eastern hemlock-----	---	---	
							Eastern white pine--	---	---	
							Paper birch---------	63	72	
							Quaking aspen-------	---	---	
							Sugar maple---------	---	---	
							White spruce--------	54	100	
28B:										
East Lake------	2S	Slight	Moderate	Moderate	Slight	Slight	Jack pine-----------	---	---	Eastern white pine, jack pine, red pine.
							Quaking aspen-------	---	---	
							Red pine------------	55	86	
28C:										
East Lake------	2S	Slight	Moderate	Moderate	Slight	Slight	Jack pine-----------	---	---	Eastern white pine, jack pine, red pine.
							Quaking aspen-------	---	---	
							Red pine------------	55	86	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
28E:										
East Lake	2R	Moderate	Moderate	Moderate	Slight	Slight	Jack pine	---	---	Eastern white pine, jack pine, red pine.
							Quaking aspen	---	---	
							Red pine	55	86	
32B:										
Kellogg	3S	Slight	Moderate	Moderate	Slight	Moderate	American basswood	---	---	Eastern white pine, red maple, red pine, sugar maple.
							Balsam fir	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Sugar maple	67	43	
							Yellow birch	---	---	
33B:										
Mancelona	3A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Sugar maple	58	43	
							White ash	---	---	
							Yellow birch	---	---	
33C:										
Mancelona	3A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Sugar maple	58	43	
							White ash	---	---	
							Yellow birch	---	---	
33D:										
Mancelona	3A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Sugar maple	58	43	
							White ash	---	---	
							Yellow birch	---	---	
33E:										
Mancelona	3R	Moderate	Moderate	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Sugar maple	58	43	
							White ash	---	---	
							Yellow birch	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
47D:										
Graycalm-------	6S	Slight	Moderate	Moderate	Slight	Slight	Bigtooth aspen------	70	86	Eastern white pine, northern red oak, red maple, red pine.
							Black cherry--------	---	---	
							Eastern white pine--	---	---	
							Jack pine-----------	56	86	
							Northern pin oak----	---	---	
							Northern red oak----	62	57	
							Quaking aspen-------	60	57	
							Red maple-----------	---	---	
							Red pine------------	61	100	
47F:										
Graycalm-------	6R	Moderate	Moderate	Moderate	Slight	Slight	Bigtooth aspen------	70	86	Eastern white pine, northern red oak, red maple, red pine.
							Black cherry--------	---	---	
							Eastern white pine--	---	---	
							Jack pine-----------	56	86	
							Northern pin oak----	---	---	
							Northern red oak----	62	57	
							Quaking aspen-------	60	57	
							Red maple-----------	---	---	
							Red pine------------	61	100	
49B:										
Kalkaska-------	3S	Slight	Moderate	Moderate	Slight	Slight	American basswood---	---	---	Eastern white pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Bigtooth aspen------	80	100	
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
							Sugar maple---------	64	43	
							White oak-----------	---	---	
							Yellow birch--------	---	---	
50B:										
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Severe	Balsam fir----------	---	---	Norway spruce, black ash, eastern white pine, red maple, red pine, white spruce.
							Black ash-----------	---	---	
							Black spruce--------	---	---	
							Eastern white pine--	---	---	
							Northern whitecedar	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	70	86	
							Red maple-----------	65	43	
							Red pine------------	---	---	
							Yellow birch--------	---	---	
Kinross--------	2W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	---
							Black spruce--------	---	---	
							Eastern white pine--	---	---	
							Jack pine-----------	---	---	
							Northern whitecedar	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	45	29	
							Red maple-----------	---	---	
							Tamarack------------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
50B:										
Croswell	5S	Slight	Moderate	Moderate	Moderate	Moderate	Balsam fir	---	---	Eastern white pine, northern red oak, red maple, red pine, white spruce.
							Eastern white pine	---	---	
							Jack pine	53	72	
							Northern red oak	---	---	
							Quaking aspen	68	72	
							Red maple	---	---	
							Red pine	55	86	
51:										
Tawas	5W	Slight	Severe	Severe	Severe	Severe	Balsam fir	40	72	---
							Black ash	---	---	
							Black spruce	20	29	
							Eastern hemlock	---	---	
							Northern whitecedar	---	---	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red maple	---	---	
							Tamarack	---	---	
							Yellow birch	---	---	
Leafriver	2W	Slight	Severe	Severe	Severe	Severe	Balsam fir	---	---	---
							Black spruce	---	---	
							Eastern white pine	---	---	
							Northern whitecedar	---	---	
							Quaking aspen	45	29	
							Red maple	---	---	
							Tamarack	---	---	
52B:										
Blue Lake	3A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Balsam fir	---	---	
							Bigtooth aspen	---	---	
							Black cherry	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Quaking aspen	---	---	
							Sugar maple	64	43	
							White ash	---	---	
							White spruce	---	---	
							Yellow birch	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
52D:										
Blue Lake------	3A	Slight	Slight	Slight	Slight	Moderate	American basswood---	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Balsam fir----------	---	---	
							Bigtooth aspen------	---	---	
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Quaking aspen-------	---	---	
							Sugar maple---------	64	43	
							White ash-----------	---	---	
							White spruce--------	---	---	
							Yellow birch--------	---	---	
52E:										
Blue Lake------	3R	Moderate	Moderate	Slight	Slight	Moderate	American basswood---	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Balsam fir----------	---	---	
							Bigtooth aspen------	---	---	
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Quaking aspen-------	---	---	
							Sugar maple---------	64	43	
							White ash-----------	---	---	
							White spruce--------	---	---	
							Yellow birch--------	---	---	
64B:										
Feldhauser-----	3A	Slight	Moderate	Slight	Slight	Moderate	American basswood---	---	---	Carolina poplar, Norway spruce, eastern white pine, red maple, red pine, sugar maple.
							American beech------	---	---	
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Sugar maple---------	60	43	
							Yellow birch--------	---	---	
65F:										
Rubicon--------	4R	Moderate	Moderate	Moderate	Slight	Slight	American beech------	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen------	66	72	
							Eastern white pine--	45	72	
							Jack pine-----------	53	72	
							Northern red oak----	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	60	57	
							Red maple-----------	57	29	
							Red pine------------	53	86	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
		Management concerns					Potential productivity			
75B:										
Rubicon	4S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen	66	72	
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	53	86	
75D:										
Rubicon	4S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen	66	72	
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	53	86	
75E:										
Rubicon	4R	Moderate	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen	66	72	
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	53	86	
81B:										
Grayling	4S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	48	57	Jack pine, red pine.
							Northern pin oak	43	29	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red pine	---	---	
81D:										
Grayling	4S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	48	57	Jack pine, red pine.
							Northern pin oak	43	29	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red pine	---	---	
81E:										
Grayling	4R	Moderate	Moderate	Moderate	Slight	Slight	Jack pine	48	57	Jack pine, red pine.
							Northern pin oak	43	29	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red pine	---	---	
81F:										
Grayling	4R	Moderate	Moderate	Moderate	Slight	Slight	Jack pine	48	57	Jack pine, red pine.
							Northern pin oak	43	29	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red pine	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
90B:										
Chinwhisker	6S	Slight	Moderate	Moderate	Slight	Moderate	Balsam fir	---	---	Eastern white pine, jack pine, white spruce.
							Bigtooth aspen	70	86	
							Eastern white pine	---	---	
							Jack pine	56	86	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red maple	---	---	
							Red pine	---	---	
95D:										
Menominee	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	American basswood, eastern white pine, sugar maple, white ash, white spruce.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Paper birch	---	---	
							Sugar maple	---	---	
							White ash	77	72	
							Yellow birch	---	---	
95E:										
Menominee	6R	Moderate	Moderate	Moderate	Slight	Moderate	American basswood	---	---	American basswood, eastern white pine, sugar maple, white ash, white spruce.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Paper birch	---	---	
							Sugar maple	---	---	
							White ash	77	72	
							Yellow birch	---	---	
113:										
Angelica	7W	Slight	Severe	Severe	Severe	Severe	American elm	---	---	Balsam fir, northern whitecedar, sugar maple, white spruce.
							Black ash	---	---	
115D:										
Kalkaska	3S	Slight	Moderate	Moderate	Slight	Slight	American basswood	---	---	Eastern white pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Bigtooth aspen	80	100	
							Black cherry	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red pine	---	---	
							Sugar maple	64	43	
							White oak	---	---	
							Yellow birch	---	---	
116B:										
Mancelona	3S	Slight	Slight	Slight	Slight	Moderate	Eastern white pine	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							Jack pine	---	---	
							Northern red oak	---	---	
							Red pine	---	---	
							Sugar maple	58	43	
							Yellow birch	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
127:										
Cathro	5W	Slight	Severe	Severe	Severe	Severe	Balsam fir	40	72	White spruce.
							Black ash	---	---	
							Black spruce	15	29	
							Eastern hemlock	---	---	
							Eastern white pine	---	---	
							Northern whitecedar	15	29	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Tamarack	35	29	
							Yellow birch	---	---	
141B:										
Leelanau	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce, yellow birch.
							American beech	---	---	
							Bigtooth aspen	70	86	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Paper birch	---	---	
							Red maple	---	---	
							Red pine	---	---	
							Sugar maple	---	---	
							White ash	---	---	
141C:										
Leelanau	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce, yellow birch.
							American beech	---	---	
							Bigtooth aspen	70	86	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Paper birch	---	---	
							Red maple	---	---	
							Red pine	---	---	
							Sugar maple	---	---	
							White ash	---	---	
141D:										
Leelanau	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce, yellow birch.
							American beech	---	---	
							Bigtooth aspen	70	86	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Paper birch	---	---	
							Red maple	---	---	
							Red pine	---	---	
							Sugar maple	---	---	
							White ash	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
146F:										
Rubicon	4R	Moderate	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen	66	72	
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	53	86	
Graycalm	6R	Moderate	Moderate	Moderate	Slight	Slight	Bigtooth aspen	70	86	Eastern white pine, northern red oak, red maple, red pine.
							Black cherry	---	---	
							Eastern white pine	---	---	
							Jack pine	56	86	
							Northern pin oak	---	---	
							Northern red oak	62	57	
							Quaking aspen	60	57	
							Red maple	---	---	
							Red pine	61	100	
147B:										
Lindquist	6S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	54	86	
							Sugar maple	---	---	
							White spruce	---	---	
147C:										
Lindquist	6S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	54	86	
							Sugar maple	---	---	
							White spruce	---	---	
147D:										
Lindquist	6S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	54	86	
							Sugar maple	---	---	
							White spruce	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
147E:										
Lindquist	6R	Moderate	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	54	86	
							Sugar maple	---	---	
							White spruce	---	---	
166A:										
Slade	3W	Slight	Severe	Moderate	Severe	Severe	American elm	---	---	Eastern white pine, red maple, sugar maple, white spruce.
							Balsam fir	---	---	
							Eastern hemlock	---	---	
							Paper birch	---	---	
							Quaking aspen	---	---	
							Red maple	---	---	
							Sugar maple	---	---	
							White spruce	---	---	
197A:										
Gladwin	5W	Slight	Severe	Moderate	Severe	Severe	Balsam fir	---	---	Black ash, eastern white pine, red maple, white spruce.
							Bigtooth aspen	---	---	
							Eastern white pine	55	100	
							Paper birch	69	86	
							Quaking aspen	68	72	
							Red maple	---	---	
							White oak	55	43	
							White spruce	---	---	
323B:										
East Lake	2S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	---	---	Eastern white pine, jack pine, red pine.
							Quaking aspen	---	---	
							Red pine	55	86	
Rubicon	4S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen	66	72	
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	53	86	
323C:										
East Lake	2S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	---	---	Eastern white pine, jack pine, red pine.
							Quaking aspen	---	---	
							Red pine	55	86	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
323C:										
Rubicon	4S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen	66	72	
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	53	86	
337B:										
Mancelona	3A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Sugar maple	58	43	
							White ash	---	---	
							Yellow birch	---	---	
East Lake	2S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	---	---	Eastern white pine, jack pine, red pine.
							Quaking aspen	---	---	
							Red pine	55	86	
337C:										
Mancelona	3A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Sugar maple	58	43	
							White ash	---	---	
							Yellow birch	---	---	
East Lake	2S	Slight	Moderate	Moderate	Slight	Slight	Jack pine	---	---	Eastern white pine, jack pine, red pine.
							Quaking aspen	---	---	
							Red pine	55	86	
338B:										
Islandlake	3S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Blue spruce, eastern white pine, northern red oak, red maple, red pine, white spruce.
							Northern red oak	---	---	
							Quaking aspen	---	---	
							Red maple	---	---	
							Red pine	---	---	
							Sugar maple	64	43	
							Yellow birch	---	---	
338C:										
Islandlake	3S	Slight	Moderate	Moderate	Slight	Slight	American beech	---	---	Blue spruce, eastern white pine, northern red oak, red maple, red pine, white spruce.
							Northern red oak	---	---	
							Quaking aspen	---	---	
							Red maple	---	---	
							Red pine	---	---	
							Sugar maple	64	43	
							Yellow birch	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
338D:										
Islandlake-----	3S	Slight	Moderate	Moderate	Slight	Slight	American beech------	---	---	Blue spruce, eastern white pine, northern red oak, red maple, red pine, white spruce.
							Northern red oak----	---	---	
							Quaking aspen-------	---	---	
							Red maple-----------	---	---	
							Red pine------------	---	---	
							Sugar maple---------	64	43	
							Yellow birch--------	---	---	
347F:										
Kalkaska-------	3R	Moderate	Moderate	Moderate	Slight	Slight	American basswood---	---	---	Eastern white pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Bigtooth aspen------	80	100	
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
							Sugar maple---------	64	43	
							White oak-----------	---	---	
							Yellow birch--------	---	---	
349B:										
Hartwick-------	4S	Slight	Moderate	Moderate	Slight	Slight	Eastern white pine--	---	---	Eastern white pine, jack pine, red pine.
							Northern red oak----	---	---	
							Quaking aspen-------	60	57	
							Red maple-----------	53	29	
350D:										
Blue Lake------	3S	Slight	Moderate	Moderate	Slight	Moderate	American basswood---	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Eastern white pine--	---	---	
							Quaking aspen-------	---	---	
							Red maple-----------	---	---	
							Sugar maple---------	64	43	
							Yellow birch--------	---	---	
352B:										
Deford---------	4W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	Black ash, eastern white pine, red maple, white spruce.
							Black spruce--------	---	---	
							Jack pine-----------	---	---	
							Northern whitecedar	---	---	
							Quaking aspen-------	60	57	
							Red maple-----------	64	43	
							Red pine------------	---	---	
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Severe	Balsam fir----------	---	---	Norway spruce, black ash, eastern white pine, red maple, red pine, white spruce.
							Black ash-----------	---	---	
							Black spruce--------	---	---	
							Eastern white pine--	---	---	
							Northern whitecedar	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	70	86	
							Red maple-----------	65	43	
							Red pine------------	---	---	
							Yellow birch--------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
352B:										
Croswell-------	5S	Slight	Moderate	Moderate	Moderate	Moderate	Balsam fir----------	---	---	Eastern white
							Eastern white pine--	---	---	pine, northern
							Jack pine-----------	53	72	red oak, red
							Quaking aspen-------	68	72	maple, red
							Red maple-----------	---	---	pine, white
							Red pine------------	55	86	spruce.
354F:										
Mancelona------	3R	Severe	Severe	Moderate	Slight	Moderate	American basswood---	---	---	Eastern white
							American beech------	---	---	pine, jack
							Eastern hemlock-----	---	---	pine, northern
							Eastern hophornbeam-	---	---	red oak, red
							Eastern white pine--	---	---	maple, red
							Northern red oak----	---	---	pine.
							Sugar maple---------	58	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	
Blue Lake------	3R	Severe	Severe	Moderate	Slight	Moderate	American basswood---	---	---	Eastern white
							American beech------	---	---	pine, jack
							Balsam fir----------	---	---	pine, northern
							Bigtooth aspen------	---	---	red oak, red
							Black cherry--------	---	---	maple, red
							Eastern hemlock-----	---	---	pine.
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Quaking aspen-------	---	---	
							Sugar maple---------	64	43	
							White ash-----------	---	---	
							White spruce--------	---	---	
							Yellow birch--------	---	---	
360:										
Wakeley--------	3W	Slight	Severe	Severe	Severe	Severe	American elm--------	---	---	Northern
							Balsam poplar-------	---	---	whitecedar.
							Northern whitecedar	---	---	
362D:										
Millersburg----	3A	Slight	Slight	Slight	Slight	Moderate	Black cherry--------	---	---	Norway spruce,
							Eastern white pine--	---	---	jack pine,
							Jack pine-----------	---	---	northern red
							Northern red oak----	---	---	oak, red
							Quaking aspen-------	---	---	maple, red
							Red maple-----------	---	---	pine, white
							Red pine------------	---	---	spruce.
							Sugar maple---------	65	43	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
365F:										
Blue Lake------	3R	Moderate	Moderate	Slight	Slight	Moderate	American basswood---	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Balsam fir----------	---	---	
							Bigtooth aspen------	---	---	
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Quaking aspen-------	---	---	
							Sugar maple---------	64	43	
							White ash-----------	---	---	
							White spruce--------	---	---	
							Yellow birch--------	---	---	
368A:										
Au Gres--------	6W	Slight	Severe	Moderate	Severe	Severe	Balsam fir----------	---	---	Norway spruce, black ash, eastern white pine, red maple, red pine, white spruce.
							Black ash-----------	---	---	
							Black spruce--------	---	---	
							Eastern white pine--	---	---	
							Northern whitecedar	---	---	
							Paper birch---------	---	---	
							Quaking aspen-------	70	86	
							Red maple-----------	65	43	
							Red pine------------	---	---	
							Yellow birch--------	---	---	
Deford---------	4W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	Black ash, eastern white pine, red maple, white spruce.
							Black spruce--------	---	---	
							Jack pine-----------	---	---	
							Northern whitecedar	---	---	
							Quaking aspen-------	60	57	
							Red maple-----------	64	43	
							Red pine------------	---	---	
369:										
Deford---------	4W	Slight	Severe	Severe	Severe	Severe	Balsam fir----------	---	---	Black ash, eastern white pine, red maple, white spruce.
							Black spruce--------	---	---	
							Jack pine-----------	---	---	
							Northern whitecedar	---	---	
							Quaking aspen-------	60	57	
							Red maple-----------	64	43	
							Red pine------------	---	---	
387F:										
Mancelona------	3R	Severe	Severe	Moderate	Slight	Moderate	American basswood---	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Sugar maple---------	58	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
387F:										
Rubicon	4R	Severe	Severe	Moderate	Slight	Slight	American beech	---	---	Eastern white pine, jack pine, red pine.
							Bigtooth aspen	66	72	
							Eastern white pine	45	72	
							Jack pine	53	72	
							Northern red oak	---	---	
							Paper birch	---	---	
							Quaking aspen	60	57	
							Red maple	57	29	
							Red pine	53	86	
393B:										
Morganlake	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce.
							American beech	---	---	
							Bigtooth aspen	76	86	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Northern red oak	63	57	
							Paper birch	---	---	
							Quaking aspen	74	86	
							Sugar maple	---	---	
							White ash	---	---	
							Yellow birch	---	---	
393C:										
Morganlake	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce.
							American beech	---	---	
							Bigtooth aspen	76	86	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Northern red oak	63	57	
							Paper birch	---	---	
							Quaking aspen	74	86	
							Sugar maple	---	---	
							White ash	---	---	
							Yellow birch	---	---	
399D:										
Menominee	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	American basswood, eastern white pine, sugar maple, white ash, white spruce.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Paper birch	---	---	
							Sugar maple	---	---	
							White ash	77	72	
							Yellow birch	---	---	
Bamfield	3S	Moderate	Moderate	Slight	Slight	Moderate	American basswood	---	---	American basswood, Norway spruce, eastern white pine, sugar maple, white ash, white spruce.
							American beech	---	---	
							Bigtooth aspen	---	---	
							Eastern hemlock	---	---	
							Northern red oak	---	---	
							Sugar maple	61	43	
							White ash	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber*	Suggested trees to plant
399D:										
Blue Lake	3S	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Balsam fir	---	---	
							Bigtooth aspen	---	---	
							Black cherry	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Quaking aspen	---	---	
							Sugar maple	64	43	
							White ash	---	---	
							White spruce	---	---	
							Yellow birch	---	---	
400F:										
Menominee	6R	Severe	Severe	Severe	Slight	Moderate	American basswood	---	---	American basswood, eastern white pine, sugar maple, white ash, white spruce.
							American beech	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Paper birch	---	---	
							Sugar maple	---	---	
							White ash	77	72	
							Yellow birch	---	---	
Bamfield	3R	Severe	Severe	Slight	Slight	Moderate	American basswood	---	---	American basswood, Norway spruce, eastern white pine, sugar maple, white ash, white spruce.
							American beech	---	---	
							Bigtooth aspen	---	---	
							Eastern hemlock	---	---	
							Northern red oak	---	---	
							Sugar maple	61	43	
							White ash	---	---	
Blue Lake	3R	Severe	Severe	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Balsam fir	---	---	
							Bigtooth aspen	---	---	
							Black cherry	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Quaking aspen	---	---	
							Sugar maple	64	43	
							White ash	---	---	
							White spruce	---	---	
							Yellow birch	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
401F:										
Lindquist------	6R	Moderate	Moderate	Moderate	Slight	Slight	American beech------	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	45	72	
							Jack pine-----------	53	72	
							Quaking aspen-------	60	57	
							Red maple-----------	57	29	
							Red pine------------	54	86	
							Sugar maple---------	---	---	
							White spruce--------	---	---	
							Yellow birch--------	---	---	
402B:										
Islandlake-----	3A	Slight	Moderate	Moderate	Slight	Slight	Black cherry--------	---	---	Blue spruce, eastern white pine, northern red oak, red maple, red pine, white spruce.
							Eastern white pine--	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
							Sugar maple---------	64	43	
402C:										
Islandlake-----	3A	Slight	Moderate	Moderate	Slight	Slight	Black cherry--------	---	---	Blue spruce, eastern white pine, northern red oak, red maple, red pine, white spruce.
							Eastern white pine--	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
							Sugar maple---------	64	43	
402D:										
Islandlake-----	3A	Slight	Moderate	Moderate	Slight	Slight	Black cherry--------	---	---	Blue spruce, eastern white pine, northern red oak, red maple, red pine.
							Eastern white pine--	---	---	
							Quaking aspen-------	---	---	
							Red pine------------	---	---	
							Sugar maple---------	64	43	
424B:										
Morganlake-----	6A	Slight	Slight	Slight	Slight	Moderate	American basswood---	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce.
							American beech------	---	---	
							Bigtooth aspen------	76	86	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Northern red oak----	63	57	
							Paper birch---------	---	---	
							Quaking aspen-------	74	86	
							Sugar maple---------	---	---	
							White ash-----------	---	---	
							Yellow birch--------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
424B:										
Ossineke	4L	Slight	Moderate	Slight	Moderate	Moderate	American basswood	---	---	Norway spruce, eastern white pine, red maple, sugar maple, white spruce.
							American beech	---	---	
							Bigtooth aspen	---	---	
							Eastern hemlock	---	---	
							Northern red oak	65	57	
							Paper birch	---	---	
							Sugar maple	63	43	
							White ash	---	---	
							White spruce	---	---	
Blue Lake	3A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech	---	---	
							Balsam fir	---	---	
							Bigtooth aspen	---	---	
							Black cherry	---	---	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Eastern white pine	---	---	
							Northern red oak	---	---	
							Quaking aspen	---	---	
							Sugar maple	64	43	
							White ash	---	---	
							White spruce	---	---	
							Yellow birch	---	---	
424C:										
Morganlake	6A	Slight	Slight	Slight	Slight	Moderate	American basswood	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce.
							American beech	---	---	
							Bigtooth aspen	76	86	
							Eastern hemlock	---	---	
							Eastern hophornbeam	---	---	
							Northern red oak	63	57	
							Paper birch	---	---	
							Quaking aspen	74	86	
							Sugar maple	---	---	
							White ash	---	---	
							Yellow birch	---	---	
Ossineke	4L	Slight	Moderate	Slight	Moderate	Moderate	American basswood	---	---	Norway spruce, eastern white pine, red maple, sugar maple, white spruce.
							American beech	---	---	
							Bigtooth aspen	---	---	
							Eastern hemlock	---	---	
							Northern red oak	65	57	
							Paper birch	---	---	
							Sugar maple	63	43	
							White ash	---	---	
							White spruce	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
424C:										
Blue Lake------	3A	Slight	Slight	Slight	Slight	Moderate	American basswood---	---	---	Eastern white pine, jack pine, northern red oak, red maple, red pine.
							American beech------	---	---	
							Balsam fir----------	---	---	
							Bigtooth aspen------	---	---	
							Black cherry--------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Quaking aspen-------	---	---	
							Sugar maple---------	64	43	
							White ash-----------	---	---	
							White spruce--------	---	---	
							Yellow birch--------	---	---	
452D:										
Bamfield-------	3L	Moderate	Moderate	Slight	Slight	Moderate	American basswood---	---	---	American basswood, Norway spruce, eastern white pine, sugar maple, white ash, white spruce.
							American beech------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Sugar maple---------	61	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	
452E:										
Bamfield-------	3R	Moderate	Moderate	Slight	Slight	Moderate	American basswood---	---	---	American basswood, Norway spruce, eastern white pine, sugar maple, white ash, white spruce.
							American beech------	---	---	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Sugar maple---------	61	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	
453B:										
Ossineke-------	4L	Slight	Moderate	Slight	Moderate	Moderate	American basswood---	---	---	Norway spruce, eastern white pine, red maple, sugar maple, white spruce.
							American beech------	---	---	
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Northern red oak----	65	57	
							Paper birch---------	---	---	
							Sugar maple---------	63	43	
							White ash-----------	---	---	
							White spruce--------	---	---	
453C:										
Ossineke-------	4L	Slight	Moderate	Slight	Moderate	Moderate	American basswood---	---	---	Norway spruce, eastern white pine, red maple, sugar maple, white spruce.
							American beech------	---	---	
							Bigtooth aspen------	---	---	
							Eastern hemlock-----	---	---	
							Northern red oak----	65	57	
							Paper birch---------	---	---	
							Sugar maple---------	63	43	
							White ash-----------	---	---	
							White spruce--------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Volume of wood fiber*	Suggested trees to plant
463F:										
Leelanau-------	6R	Severe	Severe	Slight	Slight	Moderate	American basswood---	---	---	Eastern white pine, red maple, red pine, sugar maple, white spruce, yellow birch.
							American beech------	---	---	
							Bigtooth aspen------	70	86	
							Eastern hemlock-----	---	---	
							Eastern hophornbeam-	---	---	
							Eastern white pine--	---	---	
							Northern red oak----	---	---	
							Paper birch---------	---	---	
							Red maple-----------	---	---	
							Red pine------------	---	---	
							Sugar maple---------	---	---	
							White ash-----------	---	---	
464B:										
Mossback-------	3L	Slight	Moderate	Slight	Slight	Moderate	American basswood---	---	---	American basswood, eastern white pine, red pine, sugar maple, white ash, white spruce.
							American beech------	---	---	
							Eastern hophornbeam-	---	---	
							Sugar maple---------	66	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	
464C:										
Mossback-------	3L	Slight	Moderate	Slight	Slight	Moderate	American basswood---	---	---	American basswood, eastern white pine, red pine, sugar maple, white ash, white spruce.
							American beech------	---	---	
							Eastern hophornbeam-	---	---	
							Sugar maple---------	66	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	
464D:										
Mossback-------	3L	Slight	Moderate	Slight	Slight	Moderate	American basswood---	---	---	American basswood, eastern white pine, red pine, sugar maple, white ash, white spruce.
							American beech------	---	---	
							Eastern hophornbeam-	---	---	
							Sugar maple---------	66	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	
464E:										
Mossback-------	3R	Severe	Severe	Moderate	Slight	Moderate	American basswood---	---	---	American basswood, eastern white pine, red pine, sugar maple, white ash, white spruce.
							American beech------	---	---	
							Eastern hophornbeam-	---	---	
							Sugar maple---------	66	43	
							White ash-----------	---	---	
							Yellow birch--------	---	---	

See footnote at end of table.

Table 9.--Forestland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume of wood fiber*	Suggested trees to plant
465:										
Caffey	2W	Slight	Severe	Severe	Severe	Severe	Balsam fir	---	---	---
							Bigtooth aspen	---	---	
							Black ash	---	---	
							Northern whitecedar	---	---	
							Paper birch	---	---	
							Quaking aspen	40	29	
							Red maple	---	---	

* Volume of wood fiber is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

Table 10.--Equipment Limitations on Forestland

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight", "moderate," and "severe.")

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
13:							
Tawas------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Lupton-----	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
14:							
Dawson-----	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Loxley-----	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
15A:							
Croswell---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
Au Gres----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
16B--------- Graycalm	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
17A, 17B---- Croswell	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
18A--------- Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
19:							
Leafriver--	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
20B:							
Graycalm---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
Grayling---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
20D:							
Graycalm---	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
Grayling---	Moderate: too sandy.	Moderate: too sandy. slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.

See footnote at end of table.

Table 10.--Equipment Limitations on Forestland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
20F:							
Graycalm	Moderate*: too sandy, slope.	Severe: slope.	Moderate*: too sandy, slope.	Spring, fall, winter.	Moderate*: slope.	Severe: slope.	Moderate*: slope.
Grayling	Moderate*: too sandy, slope.	Severe: slope.	Moderate*: too sandy, slope.	Spring, fall, winter.	Moderate*: slope.	Severe: slope.	Moderate*: slope.
23:							
Ausable	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Bowstring	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
24A:							
Kinross	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
Au Gres	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight	Slight	Slight.
25B Kent	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, winter	Slight	Slight	Slight.
25C Kent	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, winter	Slight	Moderate: slope.	Slight.
28B East Lake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
28C East Lake	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.
28E East Lake	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
32B Kellogg	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight	Slight.
33B Mancelona	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
33C, 33D Mancelona	Slight	Moderate*: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
33E Mancelona	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.	Moderate: slope.
47D Graycalm	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.	Slight.

See footnote at end of table.

Table 10.--Equipment Limitations on Forestland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Log landings	Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Log landings	Haul roads
47F--------- Graycalm	Moderate*: slope.	Severe: slope.	Moderate*: slope.	Spring, fall, winter.	Moderate*: slope.	Severe: slope.	Moderate*: slope.
49B--------- Kalkaska	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
50B:							
Au Gres----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
Kinross----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
Croswell---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
51:							
Tawas------	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
Leafriver--	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
52B--------- Blue Lake	Slight--------	Slight--------	Slight--------	Year round-----	Slight--------	Slight--------	Slight.
52D--------- Blue Lake	Slight--------	Moderate: slope.	Slight--------	Year round-----	Slight--------	Moderate: slope.	Slight.
52E--------- Blue Lake	Moderate------ slope.	Severe: slope.	Moderate------ slope.	Year round-----	Moderate: slope.	Severe: slope.	Moderate: slope.
64B--------- Feldhauser	Moderate: low strength.	Slight--------	Moderate: low strength.	Summer, winter	Slight--------	Slight--------	Slight.
65F--------- Rubicon	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
75B--------- Rubicon	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall winter.	Slight--------	Slight--------	Slight.
75D--------- Rubicon	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall winter.	Slight--------	Moderate: slope.	Slight.
75E--------- Rubicon	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
81B--------- Grayling	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
81D--------- Grayling	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.

See footnote at end of table.

Table 10.--Equipment Limitations on Forestland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
81E--------- Grayling	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
81F--------- Grayling	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
90B--------- Chinwhisker	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
95D--------- Menominee	Slight---------	Moderate: slope.	Slight--------	Year round-----	Slight--------	Moderate: slope.	Slight.
95E--------- Menominee	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round-----	Moderate: slope.	Severe: slope.	Moderate: slope.
113--------- Angelica	Severe: low strength, wetness.	Severe: low strength, wetness.	Severe: low strength, wetness.	Summer, winter	Slight--------	Slight--------	Slight.
115D-------- Kalkaska	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
116B-------- Mancelona	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
127--------- Cathro	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength.	Moderate: low strength.
141B-------- Leelanau	Slight---------	Slight--------	Slight--------	Year round-----	Slight--------	Slight--------	Slight.
141C-------- Leelanau	Slight---------	Moderate: slope.	Slight--------	Year round-----	Slight--------	Moderate: slope.	Slight.
141D-------- Leelanau	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round-----	Moderate: slope.	Severe: slope.	Moderate: slope.
146F:							
Rubicon----	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Graycalm---	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
147B-------- Lindquist	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
147C, 147D-- Lindquist	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
147E-------- Lindquist	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

Table 10.--Equipment Limitations on Forestland--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operating season(s)		
	Logging areas and skid roads	Log landings	Haul roads		Logging areas and skid roads	Log landings	Haul roads
166A-------- Slade	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe wetness, low strength.	Summer, winter	Slight--------	Slight--------	Slight.
197A-------- Gladwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
323B:							
East Lake--	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall---	Slight--------	Slight--------	Slight.
Rubicon----	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall---	Slight--------	Slight--------	Slight.
323C:							
East Lake--	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall---	Slight--------	Moderate: slope.	Slight.
Rubicon----	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall---	Slight--------	Moderate: slope.	Slight.
337B:							
Mancelona--	Slight---------	Slight--------	Slight.	Year round-----	Slight--------	Slight--------	Slight.
East Lake--	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall---	Slight--------	Slight--------	Slight.
337C:							
Mancelona--	Slight---------	Moderate: slope.	Slight--------	Year round-----	Slight--------	Moderate: slope.	Slight.
East Lake--	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall---	Slight--------	Moderate: slope.	Slight.
338B-------- Islandlake	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
338C, 338D-- Islandlake	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
347F-------- Kalkaska	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
349B-------- Hartwick	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
350D-------- Blue Lake	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.
352B:							
Deford-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.

See footnote at end of table.

Table 10.--Equipment Limitations on Forestland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
352B:							
Au Gres----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
Croswell---	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight--------	Slight--------	Slight.
354F:							
Mancelona--	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Blue Lake--	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
360--------- Wakeley	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
362D-------- Millersburg	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
365F-------- Blue Lake	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
368A:							
Au Gres----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
Deford-----	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter	Slight--------	Slight--------	Slight.
369--------- Deford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter, summer	Slight--------	Slight--------	Slight.
387F: Mancelona--	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall winter.	Severe: slope.	Severe: slope.	Severe: slope.
Rubicon----	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
393B-------- Morganlake	Slight---------	Slight--------	Slight--------	Year round-----	Slight--------	Slight--------	Slight.
393C-------- Morganlake	Slight---------	Moderate: slope.	Slight--------	Year round-----	Slight--------	Moderate: slope.	Slight.
399D:							
Menominee--	Slight---------	Moderate: slope.	Slight--------	Year round-----	Slight--------	Moderate: slope.	Slight.
Bamfield---	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight--------	Moderate: slope.	Slight.
Blue Lake--	Slight---------	Moderate: slope.	Slight--------	Spring, fall, winter.	Slight--------	Moderate: slope.	Slight.

See footnote at end of table.

Table 10.--Equipment Limitations on Forestland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
400F:							
Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.	Severe: slope.
Bamfield	Severe: low strength, slope.	Severe: slope.	Severe: low strength, slope.	Summer, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
Blue Lake	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.	Severe: slope.
401F: Lindquist	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall winter.	Severe: slope.	Severe: slope.	Severe: slope.
402B Islandlake	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
402C, 402D Islandlake	Slight	Moderate*: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
424B:							
Morganlake	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
Ossineke	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, fall, winter.	Slight	Slight	Slight.
Blue Lake	Slight	Slight	Slight	Year round	Slight	Slight	Slight.
424C:							
Morganlake	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
Ossineke	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight.
Blue Lake	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.	Slight.
452D Bamfield	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, fall, winter.	Slight	Moderate: slope.	Slight:
452E Bamfield	Moderate: low strength, slope.	Severe: slope.	Moderate: low strength, slope.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
453B Ossineke	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, winter	Slight	Slight	Slight.
453C Ossineke	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, winter	Slight	Moderate: slope.	Slight.
463F Leelanau	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall winter.	Severe: slope.	Severe: slope.	Severe: slope.
464B Mossback	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Summer, winter	Slight	Slight	Slight.

See footnote at end of table.

Table 10.--Equipment Limitations on Forestland--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid roads	Ratings for most limiting season(s): Log landings	Ratings for most limiting season(s): Haul roads	Preferred operating season(s)	Ratings for preferred operating season(s): Logging areas and skid roads	Ratings for preferred operating season(s): Log landings	Ratings for preferred operating season(s): Haul roads
464C, 464D-- Mossback	Moderate: low strength.	Moderate: low strength, slope.	Moderate: low strength.	Summer, winter	Slight--------	Moderate: slope.	Slight.
464E-------- Mossback	Moderate: low strength, slope.	Severe: slope.	Moderate: low strength, slope.	Summer, fall, winter.	Moderate: slope.	Severe: slope.	Moderate: slope.
465--------- Caffey	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter, summer	Moderate: low strength.	Severe: low strength.	Moderate: low strength.

* Part of the soil may be rated severe.

Table 11.--Plant Communities on Selected Soils

(Absence of an entry indicates that information was not available)

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
13--------------------	N. whitecedar-------4	Black spruce--------2	Speckled alder------4	Crested fern--------2	Sphagnum moss spp.---4
Tawas-Lupton mucks	Black spruce--------3	Balsam fir----------2	Leatherleaf---------2	Sensitive fern------2	Lowbush blueberry----3
	Quaking aspen-------3	Red maple-----------2	Redosier dogwood----1	Oak fern------------1	Sedge spp.-----------3
	Black ash-----------2	Eastern hemlock-----2	Moosewood-----------1	Cinnamon fern-------1	Canada mayflower-----3
	Paper birch---------2	N. whitecedar-------2		Interrupted fern----1	Miterwort spp.-------3
	Balsam fir----------2			Long beechfern------1	Goldthread-----------3
	Tamarack------------2			Shield fern---------1	Sphagnum moss--------2
	Eastern hemlock-----2				Wintergreen----------2
	Red maple-----------1				Grass spp.-----------2
	Yellow birch--------1				Jewelweed------------2
					Cattail spp.---------2
					Wild sarsaparilla----2
					Bunchberry-----------2
					Trout lily-----------2
					Gay wings------------2
					Horsetail spp.-------2
					Starflower-----------2
					Marsh marigold-------1
					Bramble spp.---------1
					Labrador tea---------1
14*-------------------	E. white pine-------2		Leatherleaf---------4		Sphagnum moss--------5
Dawson-Loxley peats	Red pine------------1		Redosier dogwood----1		Blueberry spp.-------3
	Black spruce--------1				Pale laurel----------3
					Sedge spp.-----------2
15A:					
Croswell sand--------	Red pine------------4	Red maple-----------3	Serviceberry--------2	Brackenfern---------4	Lowbush blueberry----4
	Quaking aspen-------3	E. white pine-------2			Wintergreen----------3
	Jack pine-----------2	Northern red oak----1			Grass spp.-----------3
	Red maple-----------2	Balsam fir----------1			Reindeer lichen------3
	E. white pine-------2				Trailing arbutus-----2
					Canada mayflower-----2
					Blue cladonia--------2
					Starflower-----------2
					Yellow beadlily------1
					Bunchberry-----------1
					Sweetfern------------1

See footnote at end of table

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
15A:					
Au Gres sand---------	Quaking aspen-------3	Chokecherry---------2	Speckled alder------2	Brackenfern---------3	Lowbush blueberry----4
	Red pine------------3	Pin cherry----------2		Cinnamon fern-------2	Wintergreen----------3
	Black spruce--------3	Red maple-----------2		Oak fern------------1	Sedge spp.-----------2
	E. white pine-------2				Trailing arbutus-----2
	Red maple-----------2				Reindeer lichen------2
	Yellow birch--------1			Ground cedar--------1	Blue cladonia--------2
	Black ash-----------1			Running pine--------1	Grass spp.-----------2
	Paper birch---------1			Ground pine---------1	Bramble spp.---------2
	Balsam fir----------1				Woodsorrel-----------2
	N. whitecedar-------1				Sphagnum moss--------2
					Sweetfern------------1
16B------------------	Northern red oak----4	Northern red oak----3	Beaked hazelnut-----2	Brackenfern---------3	Lowbush blueberry----4
Graycalm sand	Quaking aspen-------4	Pin cherry----------3	Serviceberry--------2		Wintergreen----------3
	Red pine------------3	Red maple-----------3	Hawthorne spp.------2		Bearberry------------3
	Jack pine-----------3	N. pin oak----------3	Witchhazel----------2		Grass spp.-----------3
	Red maple-----------3	Red pine------------3	Willow spp.---------2		Trailing arbutus-----2
	N. pin oak----------3	Jack pine-----------2	American fly		Starflower-----------2
	Pin cherry----------3	Bigtooth aspen------2	honeysuckle--------2		Canada mayflower-----2
	Bigtooth aspen------2	E. white pine-------2			Blue cladonia--------2
		Black cherry--------2			Bramble spp.---------2
		Quaking aspen-------1			Cowwheat-------------2
					Sweetfern------------2
					Barren strawberry----1
					Pyrola spp.----------1
					Wild sarsaparilla----1
					Wood lily spp.-------1
					Rosy twistedstalk----1
17A, 17B-------------	Red pine------------4	Red maple-----------3	Serviceberry--------2	Brackenfern---------4	Lowbush blueberry----4
Croswell sand	Quaking aspen-------3	E. white pine-------2			Wintergreen----------3
	Jack pine-----------2	Northern red oak----1			Grass spp.-----------3
	Red maple-----------2	Balsam fir----------1			Reindeer lichen------3
	E. white pine-------2				Blue cladonia--------2
					Canada mayflower-----2
					Trailing arbutus-----2
					Starflower-----------2
					Yellow beadlily------1
					Bunchberry-----------1
					Sweetfern------------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
18A------------------- Au Gres sand	Quaking aspen-------3 Red pine------------3 Black spruce--------3 E. white pine-------2 Red maple-----------2 Yellow birch--------1 Black ash-----------1 Paper birch---------1 Balsam fir----------1 N. whitecedar-------1	Chokecherry---------2 Pin cherry----------2 Red maple-----------2	Speckled alder------2	Brackenfern---------3 Cinnamon fern-------2 Oak fern------------1 Ground cedar--------1 Running pine--------1 Tree clubmoss-------1	Lowbush blueberry----4 Wintergreen----------3 Sedge spp.-----------2 Trailing arbutus-----2 Reindeer lichen------2 Blue cladonia--------2 Grass spp.-----------2 Bramble spp.---------2 Woodsorrel-----------2 Sphagnum moss--------2 Sweetfern------------1
19------------------- Leafriver muck	Tamarack------------4 Red maple-----------3 Black spruce--------3 N. whitecedar-------3 E. white pine-------1 Balsam fir----------2	Red maple-----------3 Black spruce--------3 Balsam fir----------2	Speckled alder------3 Redosier dogwood----2	Crested fern--------3 Sensitive fern------2	Sedge spp.-----------4 Mint spp.------------3 Canada mayflower-----2 Bedstraw spp.--------2 Blueberry spp.-------2 Bunchberry-----------2 Goldenrod spp.-------2 Goldthread-----------2 Jewelweed------------2 Marsh marigold-------2 Miterwort spp.-------2 Aster spp.-----------1 Starflower-----------1 Labrador tea---------1
20B, 20D, 20F--------- Graycalm-Grayling sands	Northern red oak----4 Jack pine-----------4 Quaking aspen-------3 Pin cherry----------3 Red maple-----------3 N. pin oak----------3 Red pine------------3 Bigtooth aspen------2 Paper birch---------1	Northern red oak----3 Pin cherry----------3 N. pin oak----------3 Jack pine-----------3 Red pine------------3 Red maple-----------2 Bigtooth aspen------2 Black cherry--------2 E. white pine-------2 Quaking aspen-------1	Beaked hazelnut-----2 Serviceberry--------2 American fly honeysuckle--------2 Hawthorne spp.------2 Witchhazel----------2 Willow spp.---------2	Brackenfern---------3	Lowbush blueberry----4 Sedge spp.-----------4 Trailing arbutus-----3 Grass spp.-----------3 Wintergreen----------3 Starflower-----------3 Sweetfern------------3 Blue cladonia--------3 Reindeer lichen------2 Pyrola spp.----------2 Bramble spp.---------2 Cowwheat-------------2 Canada mayflower-----2 Barren strawberry----2 Wood lily spp.-------1 Wild sarsaparilla----1 Rosy twistedstalk----1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
23-------------------- Ausable-Bowstring mucks, frequently flooded	Paper birch---------3 Eastern hemlock-----3 Balsam fir----------2 N. whitecedar-------2 Black spruce--------2	Balsam fir----------2	Speckled alder------4 Leatherleaf---------3 Viburnum spp.-------2	Cinnamon fern-------2	Sedge spp.-----------6 Bog rosemary---------4 Pale laurel----------4 Bedstraw spp.--------2 Jewelweed------------2 Marsh marigold-------2 Blue cohosh----------2 Mint spp.------------2
28B, 28C, 28E--------- East Lake sand	Quaking aspen-------4 Jack pine-----------2 Red pine------------1	Quaking aspen-------3 Chokecherry---------1	Serviceberry--------1	Brackenfern---------3	Sedge spp.-----------4 Blue cladonia--------3 Grass spp.-----------3 Hawkweed spp.--------3 Bramble spp.---------2 Reindeer lichen------2 Wild strawberry------2
32B------------------- Kellogg sand	Sugar maple---------5 Yellow birch--------3 American basswood---2 Hophornbeam---------2 Balsam fir----------2 Eastern hemlock-----1	Sugar maple---------3 American basswood---2 Balsam fir----------2 Yellow birch--------2 Eastern hemlock-----1	Serviceberry--------2	Rattlesnake fern----2 Maidenhair fern-----2 Shield fern---------2	Bedstraw spp.--------3 Grass spp.-----------3 Spring beauty--------3 Sweet cicely---------3 Trout lily-----------3 Wild leek------------3 Downy yellow violet--2 Aster spp.-----------2 Bramble spp.---------2 Currant/gooseberry---2 Rosy twistedstalk----2 Trillium spp.--------2 Canada mayflower-----2 Dutchmans breeches---2 Canada white violet 1 Smooth yellow violet 1 Blue cohosh----------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
33B, 33C, 33D, 33E----	Sugar maple---------5	Sugar maple---------4	Beaked hazelnut-----3	Brackenfern---------3	Canada mayflower-----3
Mancelona loamy sand	American basswood---3	Hophornbeam---------3	Serviceberry--------2	Maidenhair fern-----2	Trout lily-----------3
	Hophornbeam---------2	American basswood---2	Red elderberry------2	Rattlesnake fern----2	Wild leek------------3
	American beech------2	American beech------2	Silky dogwood-------2	Shield fern---------1	Bedstraw spp.--------3
	White ash-----------2	White ash-----------2			Smooth yellow violet 3
	Yellow birch--------2	Yellow birch--------2			Sedge spp.-----------2
	E. white pine-------2	E. white pine-------1			Downy yellow violet 2
	Eastern hemlock-----2	Balsam fir----------2			Bramble spp.---------2
	Northern red oak----2				Currant/gooseberry 2
					False Solomons seal--2
					Grass spp.-----------2
					Hairy Solomons seal--2
					Solomons seal--------2
					Sweet cicely---------2
					Blue cohosh----------2
					Largeleaf aster------2
					Miterwort spp.-------2
					Trillium spp.--------2
					Wild sarsaparilla----2
					Dutchmans breeches---2
					Partridgeberry-------1
					Hepatica spp.--------1
47D, 47F-------------	Northern red oak----4	Northern red oak----3	Beaked hazelnut-----2	Brackenfern---------3	Lowbush
Graycalm sand	Quaking aspen-------4	Pin cherry----------3	Serviceberry--------2		blueberry-----------4
	Red pine------------3	Red maple-----------3	Hawthorne spp.------2		Bearberry------------3
	Jack pine-----------3	N. pin oak----------3	Witchhazel----------2		Grass spp.-----------3
	Red maple-----------3	Red pine------------3	Willow spp.---------2		Wintergreen----------3
	N. pin oak----------3	Jack pine-----------2	American fly		Starflower-----------2
	Pin cherry----------3	Bigtooth aspen------2	honeysuckle--------2		Canada mayflower-----2
	Bigtooth aspen------2	E. white pine-------2			Blue cladonia--------2
		Black cherry--------2			Bramble spp.---------2
		Quaking aspen-------1			Cowwheat-------------2
					Sweetfern------------2
					Trailing arbutus-----2
					Barren strawberry----1
					Pyrola spp.----------1
					Wild sarsaparilla----1
					Wood lily spp.-------1
					Rosy twistedstalk----1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
49B-------------------	Sugar maple---------4	Sugar maple---------3	Beaked hazelnut-----2	Brackenfern---------2	Canada mayflower-----3
Kalkaska sand	American beech------3	American beech------3	Striped maple-------2	Shield fern---------2	Grass spp.-----------3
	Black cherry--------3	Black cherry--------2	Serviceberry--------1		Trout lily-----------3
	American basswood---2	Hophornbeam---------2		Running pine--------2	Partridgeberry-------2
	Bigtooth aspen------2			Shining clubmoss----2	Bedstraw spp.--------2
	Quaking aspen-------2			Ground cedar--------2	Blue cladonia--------2
	Paper birch---------2			Ground pine---------1	Dutchmans breeches- 2
	Yellow birch--------2				Rosy twistedstalk----2
	Northern red oak----2				Reindeer lichen------2
	White oak-----------2				Wild sarsaparilla----2
	E. white pine-------2				Trailing arbutus-----2
	Red pine------------2				Trillium spp.--------2
	Hophornbeam---------2				Wood betony----------1
	Eastern hemlock-----1				False Solomons seal--1
					Solomons seal--------1
					Twinflower-----------1
					Violet spp.----------1
					Wintergreen----------1
					Smooth yellow violet 1
					Wood anemone---------1
51--------------------	Tamarack------------4	Red maple-----------3	Speckled alder------4	Crested fern--------3	Sedge spp.-----------4
Tawas-Leafriver mucks	Black spruce--------4	Black spruce--------3	Redosier dogwood----2	Sensitive fern------2	Mint spp.------------3
	Red maple-----------3	Balsam fir----------2	Leatherleaf---------2		Canada mayflower-----3
	Quaking aspen-------3		Moosewood-----------1		Grass spp.-----------3
	N. whitecedar-------3				Blueberry spp.-------2
	Balsam fir----------2				Bunchberry-----------2
	Paper birch---------2				Goldenrod spp.-------2
	E. white pine-------1				Jewelweed------------2
	Black ash-----------1				Labrador tea---------2
	Yellow birch--------1				Marsh marigold-------2
					Miterwort spp.-------2
					Bedstraw spp.--------2
					Goldthread-----------2
					Gay wings------------2
					Wintergreen----------2
					Aster spp.-----------1
					Starflower-----------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
52B, 52D, 52E----------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----2	Shield fern---------2	Wild leek------------3
Blue Lake loamy sand	American basswood---3	Hophornbeam---------2	Red elderberry------2	Brackenfern---------2	Sweet cicely---------3
	Quaking aspen-------3	American basswood---2	Alternateleaf	Maidenhair fern-----2	Downy yellow violet 3
	Black cherry--------3	American beech------2	dogwood-----------2	Oak fern------------1	Bedstraw spp.--------3
	E. white pine-------3	Yellow birch--------2	Silky dogwood-------1	Rattlesnake fern----1	Spring beauty--------3
	American beech------2	Quaking aspen-------1			Canada mayflower-----2
	White ash-----------2	E. white pine-------1			Sedge spp.-----------2
	Bigtooth aspen------2	Black cherry--------1			Wintergreen----------2
	Yellow birch--------2	Balsam fir----------1			Wild sarsaparilla----2
	Hophornbeam---------2				Trillium spp.--------2
	Northern red oak----2				Grass spp.-----------2
	White spruce--------2				Hairy Solomons seal--2
	Eastern hemlock-----1				Starflower-----------2
	Balsam fir----------1				Bramble spp.---------2
					Dutchmans breeches---2
					Rosy twistedstalk----2
					Jack-in-the-pulpit---1
					Solomons seal--------1
					Indianpipe-----------1
					Blue cohosh----------1
					Violet spp.----------1
					Canada white violet 1
					Smooth yellow violet 1
					False Solomons seal--1
					Bearberry------------1
					Yellow beadlily------1
					Bunchberry-----------1
64B-------------------	Sugar maple---------5	Sugar maple---------4	American fly	Ladyfern------------2	Trout lily-----------5
Feldhauser fine sandy	American beech------3	Yellow birch--------3	honeysuckle--------1	Maidenhair fern-----2	Sweet cicely---------3
loam	American basswood---3	American beech------3		Shield fern---------2	Canada white violet 3
	Black cherry--------2	American basswood---2			Canada mayflower-----3
	Yellow birch--------2				Bedstraw spp.--------3
	Eastern hemlock-----1				Grass spp.-----------3
					Rosy twistedstalk----2
					Downy yellow violet 2
					Blue cohosh----------2
					Baneberry spp.-------2
					Currant/gooseberry---2
					Miterwort spp.-------2
					Wild sarsaparilla----1
					Hepatica spp.--------1
					Jack-in-the-pulpit---1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
65F------------------	Quaking aspen-------5	Red maple-----------3	Beaked hazelnut-----2	Brackenfern---------4	Wintergreen----------3
Rubicon sand,	Red maple-----------4	Northern red oak----3	Serviceberry--------2		Lowbush blueberry----3
dissected	Bigtooth aspen------3	Bigtooth aspen------2	Witchhazel----------2		Partridgeberry-------2
	E. white pine-------3	Pin cherry----------2	Willow spp.---------1		Blue cladonia--------2
	Northern red oak----3	E. white pine-------2			Blueberry spp.-------2
	American beech------2	Red pine------------2			Reindeer lichen------2
	Paper birch---------2				Canada mayflower-----2
	Red pine------------2				Starflower-----------2
	Jack pine-----------1				Grass spp.-----------2
					Bramble spp.---------2
					Wild strawberry------2
					Sweet cicely---------2
					Sedge spp.-----------2
					Trailing arbutus-----1
					Currant/gooseberry---1
75B, 75D, 75E---------	Quaking aspen-------5	Red maple-----------3	Beaked hazelnut-----2	Brackenfern---------4	Wintergreen----------3
Rubicon sand	Red maple-----------4	Northern red oak----3	Serviceberry--------2		Lowbush blueberry----3
	Bigtooth aspen------3	Bigtooth aspen------2	Witchhazel----------2		Partridgeberry-------2
	E. white pine-------3	Pin cherry----------2	Willow spp.---------1		Blue cladonia--------2
	Northern red oak----3	E. white pine-------2			Blueberry spp.-------2
	American beech------2	Red pine------------2			Reindeer lichen------2
	Paper birch---------2				Canada mayflower-----2
	Red pine------------2				Starflower-----------2
	Jack pine-----------1				Grass spp.-----------2
					Bramble spp.---------2
					Wild strawberry------2
					Sweet cicely---------2
					Sedge spp.-----------2
					Trailing arbutus-----1
					Currant/gooseberry---1
81B, 81D, 81E, 81F----	Jack pine-----------5	Jack pine-----------3	Serviceberry--------2	Brackenfern---------3	Lowbush blueberry----4
Grayling sand	Northern red oak----3	Northern red oak----3			Canada blueberry-----4
	Red pine------------3	Red pine------------2			Sedge spp.-----------4
	N. pin oak----------2	N. pin oak----------2			Blue cladonia--------3
	Quaking aspen-------2	Black cherry--------1			Wintergreen----------3
	Paper birch---------1	Red maple-----------1			Sweetfern------------3
					Trailing arbutus-----3
					Grass spp.-----------3
					Barren strawberry----3
					Bearberry------------3
					Reindeer lichen------2
					Canada mayflower-----2

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
90B------------------	Jack pine-----------4	Jack pine-----------3	Serviceberry--------2	Brackenfern---------4	Lowbush blueberry----4
Chinwhisker sand	Red pine------------4	Red maple-----------2			Wintergreen----------3
	E. white pine-------3	Balsam fir----------2			Blue cladonia--------3
	Bigtooth aspen------2	E. white pine-------2			Sedge spp.-----------3
	Quaking aspen-------2	Northern red oak----1			Canada mayflower-----3
	Red maple-----------2				Trailing arbutus-----2
	Balsam fir----------1				Canada blueberry-----2
					Cowwheat-------------2
					Wild strawberry------1
					Bramble spp.---------1
					Pink ladyslipper-----1
					Starflower-----------1
95D, 95E-------------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----2	Brackenfern---------2	Sweet cicely---------3
Menominee loamy sand	American basswood---3	American basswood---2	Mapleleaf viburnum--2	Rattlesnake fern----2	Smooth yellow violet 3
	American beech------2	Hophornbeam---------2	Witchhazel----------1	Shield fern---------1	Bedstraw spp.--------2
	White ash-----------2	American beech------2			Canada mayflower-----2
	Hophornbeam---------2	White ash-----------2			Dewberry spp.--------2
	Yellow birch--------2	Yellow birch--------2			Canada white violet 2
	Eastern hemlock-----1				Baneberry spp.-------1
	Paper birch---------1				
113------------------	Black ash-----------4	Black ash-----------3		Crested fern--------3	Goldenrod spp.-------3
Angelica loam	American elm--------2	American elm--------3		Sensitive fern------3	Horsetail spp.-------3
					Jewelweed------------3
					Mint spp.------------3
					Sedge spp.-----------3
					Cattail spp.---------2
					Currant/gooseberry---2
					Nettles--------------2
					Downy yellow violet 2
					Wild strawberry------2

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
115B------------------	Sugar maple---------4	Sugar maple---------3	Beaked hazelnut-----2	Brackenfern---------2	Canada mayflower-----3
Kalkaska sand	American beech------3	American beech------3	Striped maple-------2	Shield fern---------2	Grass spp.-----------3
	Black cherry--------3	Black cherry--------2	Serviceberry--------1		Trout lily-----------3
	American basswood---2	Hophornbeam---------2		Running pine--------2	Partridgeberry-------2
	Bigtooth aspen------2			Shining clubmoss----2	Bedstraw spp.--------2
	Quaking aspen-------2			Ground cedar--------2	Blue cladonia--------2
	Paper birch---------2			Ground pine---------1	Dutchmans breeches---2
	Yellow birch--------2				Rosy twistedstalk----2
	Northern red oak----2				Reindeer lichen------2
	White oak-----------2				Wild sarsaparilla----2
	E. white pine-------2				Trailing arbutus-----2
	Red pine------------2				Trillium spp.--------2
	Hophornbeam---------2				Wood betony----------1
	Eastern hemlock-----1				False Solomons seal--1
					Solomons seal--------1
					Twinflower-----------1
					Violet spp.----------1
					Wintergreen----------1
					Smooth yellow violet 1
					Wood anemone---------1
127-------------------	N. whitecedar-------5	Red maple-----------3	Speckled alder------3	Sensitive fern------4	Sedge spp.-----------4
Cathro muck	Black spruce--------4	Balsam fir----------3	Redosier dogwood----2	Royal fern----------4	Sphagnum moss--------4
	Black ash-----------3	Black ash-----------2		Ostrich fern--------3	Jewelweed------------3
	Balsam fir----------3	N. whitecedar-------2		Crested fern--------3	Horsetail spp.-------3
	Eastern hemlock-----3	Black spruce--------2			Lowbush blueberry----3
	Tamarack------------3				Goldthread-----------3
	Yellow birch--------2				Starflower-----------3
	Paper birch---------2				Yellow beadlily------3
	Quaking aspen-------2				Jewelweed------------3
	E. white pine-------1				Mint spp.------------3
					Bedstraw spp.--------2
					Bramble spp.---------2
					Marsh marigold-------2
					Canada mayflower-----2
					Labrador tea---------2
					Wintergreen----------2

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
141B, 141C, 141D------	Sugar maple---------5	Sugar maple---------4	Witchhazel----------2	Brackenfern---------2	Sweet cicely---------3
Leelanau loamy sand	Red maple-----------4	Red maple-----------3	Serviceberry--------2	Shield fern---------2	Canada mayflower-----3
	American basswood---3	American basswood---2	Mapleleaf viburnum 1	Maidenhair fern-----1	Bedstraw spp.--------3
	Northern red oak----3	American beech------2	Striped maple-------1		Currant/gooseberry---2
	E. white pine-------3	White ash-----------2	Beaked hazelnut-----1	Running pine--------1	False Solomons seal--2
	Red pine------------3	Hophornbeam---------2			Rosy twistedstalk----2
	American beech------2				Downy yellow violet 2
	White ash-----------2				Grass spp.-----------2
	Hophornbeam---------2				Wild sarsaparilla----2
	Bigtooth aspen------2				Wintergreen----------2
	Paper birch---------1				Wild leek------------2
	Eastern hemlock-----1				Partridgeberry-------2
					Starflower-----------2
					Hairy Solomons seal--2
					Indianpipe-----------1
					Pyrolas spp.---------1
					Trillium spp.--------1
146F:					
Rubicon sand---------	Quaking aspen-------5	Red maple-----------3	Beaked hazelnut-----2	Brackenfern---------4	Lowbush blueberry----4
	Red maple-----------4	Northern red oak----3	Serviceberry--------2		Blueberry spp.-------4
	Northern red oak----4	Pin cherry----------3	Witchhazel----------2		Bearberry------------3
	Bigtooth aspen------3	N. pin oak----------3	Hawthorne spp.------2		Blue cladonia--------3
	E. white pine-------3	American beech------2	American fly		Reindeer lichen------3
	Pin cherry----------3	Bigtooth aspen------2	honeysuckle--------2		Wintergreen----------3
	N. pin oak----------3	E. white pine-------2	Willow spp.---------1		Sedge spp.-----------3
	American beech------2	Black cherry--------2			Grass spp.-----------3
	Paper birch---------2	Jack pine-----------2			Starflower-----------3
	Red pine------------2	Red pine------------2			Pyrola spp.----------2
		Quaking aspen-------1			Sweetfern------------2
					Cowwheat-------------2
					Bramble spp.---------2
					Partridgeberry-------2
					Sweet cicely---------2
					Canada mayflower-----2
					Wild strawberry------2
					Trailing arbutus-----2
					Wood lily------------1
					Barren strawberry----1
					Rosy twistedstalk----1
					Wild sarsaparilla----1
					Currant/gooseberry---1
Graycalm sand.					

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
147B, 147C, 147D, 147E----------------- Lindquist sand	Sugar maple---------5	Sugar maple---------5	Canada yew----------3	Brackenfern---------3	Grass spp.-----------4
	Jack pine-----------4	Yellow birch--------3	Beaked hazelnut-----2		Lowbush blueberry----4
	Northern red oak----4	Northern red oak----3	Serviceberry--------2	Ground pine---------2	Canada mayflower-----3
	Red maple-----------3	White oak-----------3			Currant/gooseberry---3
	Red pine------------3	E. white pine-------3			Trailing arbutus-----3
	E. white pine-------3	Red pine------------3			Reindeer lichen------3
	American beech------2	American beech------2			Sweetfern------------3
	Quaking aspen-------1	Black cherry--------2			Wintergreen----------3
	White spruce--------1	Eastern hemlock-----2			Sedge spp.-----------3
					Wood lily spp.-------2
					Largeleaf aster------2
					Cowwheat-------------2
					Blue cladonia--------2
					Barren strawberry----1
					Indian paintbrush----1
					Bramble spp.---------1
323B, 323C------------ East Lake-Rubicon sands	Quaking aspen-------4	Quaking aspen-------3	Serviceberry--------1	Brackenfern---------3	Sedge spp.-----------4
	Jack pine-----------2	Chokecherry---------1			Blue cladonia--------3
	Red pine------------1				Grass spp.-----------3
					Hawkweed spp.--------3
					Goldenrod spp.-------2
					Bramble spp.---------2
					Reindeer lichen------2
					Wild strawberry------2

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
337B, 337C------------	Sugar maple---------5	Sugar maple---------4	Beaked hazelnut-----3	Brackenfern---------3	Trout lily-----------3
Mancelona-East Lake	American basswood---3	Hophornbeam---------3	Serviceberry--------2	Rattlesnake fern----2	Smooth yellow violet 3
	Hophornbeam---------2	American basswood---2	Red elderberry------2	Shield fern---------1	Canada mayflower-----3
	American beech------2	American beech------2	Silky dogwood-------2		Wild leek------------3
	White ash-----------2	White ash-----------2			Bedstraw spp.--------3
	Yellow birch--------2	Yellow birch--------2			Sedge spp.-----------2
	Northern red oak----2	E. white pine-------2			Downy yellow violet 2
	Eastern hemlock-----2	Balsam fir----------2			Bramble spp.---------2
	E. white pine-------2				Currant/gooseberry---2
					False Solomons seal--2
					Grass spp.-----------2
					Hairy Solomons seal--2
					Largeleaf aster------2
					Miterwort spp.-------2
					Blue cohosh----------2
					Sweet cicely---------2
					Trillium spp.--------2
					Wild sarsaparilla----2
					Solomons seal--------2
					Dutchmans breeches---2
					Hepatica spp.--------1
					Partridgeberry-------1
					Rosy twistedstalk----1
338B, 338C, 338D------	Sugar maple---------6	Sugar maple---------3		Brackenfern---------6	Grass spp.-----------4
Islandlake sand	Red pine------------4	Yellow birch--------3		Shield fern---------2	Canada mayflower-----3
	Quaking aspen-------3	Quaking aspen-------2			Reindeer lichen------2
	Northern red oak----3	Red maple-----------2		Running pine--------2	Blue cladonia--------2
	American beech------3	Northern red oak----2			Bramble spp.---------2
	Yellow birch--------2	American beech------2			Trillium spp.--------2
	Red maple-----------2				Lowbush blueberry----1
					Sedge spp.-----------1
					Tickclover spp.------1
					Baneberry spp.-------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
347F------------------	Sugar maple---------4	Sugar maple---------3	Beaked hazelnut-----2	Brackenfern---------2	Canada mayflower-----3
Kalkaska sand,	American beech------3	American beech------3	Striped maple-------2	Shield fern---------2	Grass spp.-----------3
dissected	Black cherry--------3	Black cherry--------2	Serviceberry--------1		Trout lily-----------3
	American basswood---2	Hophornbeam---------2		Running pine--------2	Partridgeberry-------2
	Bigtooth aspen------2			Shining clubmoss----2	Bedstraw spp.--------2
	Quaking aspen-------2			Ground cedar--------2	Blue cladonia--------2
	Paper birch---------2			Ground pine---------1	Dutchmans breeches---2
	Yellow birch--------2				Rosy twistedstalk----2
	Northern red oak----2				Reindeer lichen------2
	White oak-----------2				Wild sarsaparilla----2
	E. white pine-------2				Trailing arbutus-----2
	Red pine------------2				Trillium spp.--------2
	Hophornbeam---------2				Wood betony----------1
	Eastern hemlock-----1				False Solomons seal--1
					Solomons seal--------1
					Twinflower-----------1
					Violet spp.----------1
					Wintergreen----------1
					Smooth yellow violet 1
					Wood anemone---------1
349B------------------	Quaking aspen-------3	Quaking aspen-------3	Witchhazel----------3	Brackenfern---------5	Blueberry spp.-------4
Hartwick sand	Red maple-----------3	Red maple-----------3	Beaked hazelnut-----2		Sedge spp.-----------3
	Northern red oak----3	E. white pine-------3	Serviceberry--------2		Wintergreen----------3
	E. white pine-------3	Northern red oak----2			Blue cladonia--------2
					Bramble spp.---------2
					Largeleaf aster------2
					Starflower-----------2
					Wild strawberry------2

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
352B:					
Deford---------------	Quaking aspen-------3	Black cherry--------3	Leatherleaf---------3	Brackenfern---------2	Grass spp.-----------5
	Red maple-----------3	Quaking aspen-------2	Moosewood-----------2	Crested fern--------1	Blueberry spp.-------4
	Black spruce--------3	Red maple-----------2	American fly		Baneberry-----------3
	Balsam fir----------2	Jack pine-----------2	honeysuckle--------2	Shining clubmoss----3	Wood anemone---------3
	Jack pine-----------2	Balsam fir----------1	Redosier dogwood----2	Ground cedar--------2	Sedge spp.-----------3
	Red pine------------2			Ground pine---------1	Yellow beadlily------3
	Black spruce--------2				Sphagnum moss--------3
					Wintergreen----------3
					Blue flag------------2
					Canada mayflower-----2
					Bramble spp.---------2
					Bunchberry-----------2
					Largeleaf aster------2
					Starflower-----------2
					Violet spp.----------2
					Wild sarsaparilla----1
					Horsetail spp.-------1
Au Gres--------------	Quaking aspen-------3	Chokecherry---------2	Speckled alder------2	Brackenfern---------3	Lowbush blueberry----4
	Red pine------------3	Pin cherry----------2		Cinnamon fern-------2	Wintergreen----------3
	Black spruce--------3	Red maple-----------2		Oak fern------------1	Sedge spp.-----------2
	E. white pine-------2				Trailing arbutus-----2
	Red maple-----------2				Reindeer lichen------2
	Yellow birch--------1			Ground cedar--------1	Blue cladonia--------2
	Black ash-----------1			Running pine--------1	Grass spp.-----------2
	Paper birch---------1			Tree clubmoss-------1	Bramble spp.---------2
	Balsam fir----------1				Woodsorrel-----------2
	N. whitecedar-------1				Sphagnum moss--------2
					Sweetfern------------1
Croswell-------------	Red pine------------4	Red maple-----------3	Serviceberry--------2	Brackenfern---------4	Lowbush blueberry----4
	Quaking aspen-------3	E. white pine-------2			Grass spp.-----------3
	Jack pine-----------2	Northern red oak----1			Wintergreen----------3
	Red maple-----------2	Balsam fir----------1			Reindeer lichen------3
	E. white pine-------2				Sedge spp.-----------3
					Blue cladonia--------2
					Canada mayflower-----2
					Trailing arbutus-----2
					Starflower-----------2
					Yellow beadlily------1
					Sweetfern------------1
					Bunchberry-----------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
360------------------	American elm--------3	American elm--------2	Speckled alder------4	Sensitive fern------3	Horsetail spp.-------3
Wakeley muck	Balsam poplar-------2	Balsam poplar-------1	Meadow-sweet--------3		Blue flag------------2
			Willow spp.---------2		Jewelweed------------2
					Sedge spp.-----------2
365F-----------------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----2	Shield fern---------2	Wild leek------------3
Blue Lake loamy sand,	American basswood---3	Hophornbeam---------2	Red elderberry------2	Brackenfern---------2	Sweet cicely---------3
dissected	Quaking aspen-------3	American basswood---2	Alternateleaf	Maidenhair fern-----2	Downy yellow violet--3
	Black cherry--------3	American beech------2	dogwood------------2	Oak fern------------1	Bedstraw spp.--------3
	E. white pine-------3	Yellow birch--------2	Silky dogwood-------1	Rattlesnake fern----1	Spring beauty--------3
	American beech------2	Quaking aspen-------1			Canada mayflower-----2
	White ash-----------2	E. white pine-------1			Sedge spp.-----------2
	Bigtooth aspen------2	Black cherry--------1			Wintergreen----------2
	Yellow birch--------2	Balsam fir----------1			Wild sarsaparilla----2
	Hophornbeam---------2				Trillium spp.--------2
	Northern red oak----2				Grass spp.-----------2
	White spruce--------2				Hairy Solomons seal--2
	Eastern hemlock-----1				Starflower-----------2
	Balsam fir----------1				Bramble spp.---------2
					Dutchmans breeches---2
					Rosy twistedstalk----2
					Jack-in-the-pulpit---1
					Solomons seal--------1
					Indianpipe-----------1
					Blue cohosh----------1
					Violet spp.----------1
					Canada white violet 1
					Smooth yellow violet 1
					False Solomons seal--1
					Bearberry------------1
					Yellow beadlily------1
					Bunchberry-----------1
368A:					
Au Gres--------------	Quaking aspen-------3	Chokecherry---------2	Speckled alder------2	Brackenfern---------3	Lowbush blueberry----4
	Red pine------------3	Pin cherry----------2		Cinnamon fern-------2	Wintergreen----------3
	Black spruce--------3	Red maple-----------2		Oak fern------------1	Sedge spp.-----------2
	E. white pine-------2				Trailing arbutus-----2
	Red maple-----------2				Reindeer lichen------2
	Yellow birch--------1			Ground cedar--------1	Blue cladonia--------2
	Black ash-----------1			Running pine--------1	Grass spp.-----------2
	Paper birch---------1			Ground pine---------1	Bramble spp.---------2
	Balsam fir----------1				Woodsorrel-----------2
	N. whitecedar-------1				Sphagnum moss--------2
					Sweetfern------------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
368A:					
Deford	Quaking aspen-------3	Black cherry--------3	Leatherleaf---------3	Brackenfern---------2	Grass spp.-----------5
	Red maple-----------3	Quaking aspen-------2	Moosewood-----------2	Crested fern--------1	Blueberry spp.-------4
	Black spruce--------3	Red maple-----------2	American fly		Baneberry-----------3
	Balsam fir----------2	Jack pine-----------2	honeysuckle--------2	Shining clubmoss----3	Wood anemone---------3
	Jack pine-----------2	Balsam fir----------1	Redosier dogwood----2	Ground cedar--------2	Sedge spp.-----------3
	Red pine------------2			Ground pine---------1	Yellow beadlily------3
	Black spruce--------2				Sphagnum moss--------3
					Wintergreen----------3
					Blue flag------------2
					Canada mayflower-----2
					Bramble spp.---------2
					Bunchberry-----------2
					Largeleaf aster------2
					Starflower-----------2
					Violet spp.----------2
					Wild sarsaparilla----1
					Horsetail spp.-------1
369------------------	Quaking aspen-------3	Black cherry--------3	Leatherleaf---------3	Brackenfern---------2	Grass spp.-----------5
Deford muck	Red maple-----------3	Quaking aspen-------2	Moosewood-----------2	Crested fern--------1	Blueberry spp.-------4
	Black spruce--------3	Red maple-----------2	American fly		Baneberry-----------3
	Balsam fir----------2	Jack pine-----------2	honeysuckle--------2	Shining clubmoss----3	Wood anemone---------3
	Jack pine-----------2	Balsam fir----------1	Redosier dogwood----2	Ground cedar--------2	Sedge spp.-----------3
	Red pine------------2			Ground pine---------1	Yellow beadlily------3
	Black spruce--------2				Sphagnum moss--------3
					Wintergreen----------3
					Blue flag------------2
					Canada mayflower-----2
					Bramble spp.---------2
					Bunchberry-----------2
					Largeleaf aster------2
					Starflower-----------2
					Violet spp.----------2
					Wild sarsaparilla----1
					Horsetail spp.-------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
387F------------------	Sugar maple---------5	Sugar maple---------4	Beaked hazelnut-----3	Brackenfern---------3	Trout lily-----------3
Mancelona-Rubicon	American basswood---3	Hophornbeam---------3	Silky dogwood-------2	Rattlesnake fern----2	Smooth yellow violet 3
sands, dissected	Quaking aspen-------3	American basswood---2	Red elderberry------2	Maidenhair fern-----2	Canada mayflower-----3
	Hophornbeam---------2	American beech------2	Serviceberry--------2	Shield fern---------1	Wild leek------------3
	American beech------2	White ash-----------2	Witchhazel-nut------2		Bedstraw spp.--------3
	White ash-----------2	Yellow birch--------2	Willow spp.---------1		Sedge spp.-----------2
	Yellow birch--------2	E. white pine-------2			Bramble spp.---------2
	Northern red oak----2	Balsam fir----------2			Currant/gooseberry---2
	Eastern hemlock-----2	Bigtooth aspen------2			False Solomons seal--2
	E. white pine-------2	Northern red oak----2			Grass spp.-----------2
	Red maple-----------2	Red pine------------2			Hairy Solomons seal--2
	Bigtooth aspen------2	Pin cherry----------1			Largeleaf aster------2
	Red pine------------2				Miterwort spp.-------2
	Paper birch---------1				Blue cohosh----------2
	Jack pine-----------1				Sweet cicely---------2
					Trillium spp.--------2
					Wild sarsaparilla----2
					Solomons seal--------2
					Dutchmans breeches---2
					Blueberry spp.-------2
					Downy yellow violet 2
					Wintergreen----------2
					Blue cladonia--------1
					Reindeer lichen------1
					Rosy twistedstalk----1
					Wild strawberry------1
					Trailing arbutus-----1
					Hepatica spp.--------1
					Partridgeberry-------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
393B, 393C------------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----2	Brackenfern---------2	Sweet cicely---------3
Morganlake loamy sand	Bigtooth aspen------3	Paper birch---------3	Alternateleaf	Rattlesnake fern----2	Miterwort spp.-------3
	American beech------2	American beech------2	dogwood------------2	Shield fern---------2	Trout lily-----------3
	American basswood---2	Yellow birch--------2	Red elderberry------2		Baneberry spp.-------2
	Quaking aspen-------2	Hophornbeam---------2	Mapleleaf viburnum 2		Bedstraw spp.--------2
	Yellow birch--------2	White ash-----------2	Silky dogwood-------1		Currant/gooseberry---2
	Hophornbeam---------2	Quaking aspen-------2	Witchhazel----------1		False Solomons seal--2
	Eastern hemlock-----2	Northern red oak----2			Grass spp.-----------2
	Paper birch---------2	American basswood---2			Largeleaf aster------2
	Northern red oak----2				Dutchmans breeches---2
	White ash-----------1				Sedge spp.-----------2
					Solomons seal--------2
					Trillium spp.--------2
					Canada white violet 2
					Downy yellow violet 2
					Canada mayflower-----2
					Wild sarsaparilla----2
					Rosy twistedstalk----2
					Wild leek------------2
					Hepatica spp.--------2
					Pyrolas spp.---------2
					Gay wings------------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
399D------------------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----2	Maidenhair fern-----2	Sweet cicely---------3
Menominee-Bamfield,	American basswood---3	American basswood---2	Mapleleaf viburnum 2	Brackenfern---------2	Smooth yellow violet 3
sandy substratum-	American beech------2	Hophornbeam---------2	Red elderberry------2	Shield fern---------2	Wild leek------------3
Bamfield complex	Hophornbeam---------2	White ash-----------2	Serviceberry--------1	Rattlesnake fern----2	Bedstraw spp.--------2
	White ash-----------2	American ash--------1	Silky dogwood-------1	Oak fern------------1	Canada white violet 2
	Yellow birch--------2	Yellow birch--------1	Alternateleaf		Canada mayflower-----2
	Eastern hemlock-----1	Northern red oak----1	dogwood------------1		Trout lily-----------2
	E. white pine-------1	E. white pine-------1	Witchhazel----------1		Grass spp.-----------2
	Quaking aspen-------1		American fly		Blue cohosh----------2
	Bigtooth aspen------1		honeysuckle--------1		Rosy twistedstalk----2
	Black cherry--------1				Trillium spp.--------2
	Northern red oak----1				Downy yellow violet--2
	White spruce--------1				Dutchmans breeches---2
					Starflower-----------2
					Hepatica spp.--------2
					Spring beauty--------2
					Baneberry spp.-------1
					Dewberry spp.--------1
					Currant/gooseberry---1
					Yellow beadlily------1
					Largeleaf aster------1
					Aster spp.-----------1
					Jack-in-the-pulpit---1
					Mint spp.------------1
					Solomons seal--------1
					False Solomons seal--1
					Hairy Solomons seal--1
					Bramble spp.---------1
					Wild sarsaparilla----1
					Wintergreen----------1
					Bearberry------------1
					Bunchberry-----------1
					Sedge spp.-----------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
400F------------------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----2	Maidenhair fern-----2	Sweet cicely---------3
Menominee-Bamfield,	American basswood---3	American basswood---2	Mapleleaf viburnum 2	Brackenfern---------2	Smooth yellow violet 3
sandy substratum-	American beech------2	Hophornbeam---------2	Red elderberry------2	Shield fern---------2	Wild leek------------3
Bamfield complex,	Hophornbeam---------2	White ash-----------2	Serviceberry--------1	Rattlesnake fern----2	Bedstraw spp.--------2
dissected	White ash-----------2	American ash--------1	Silky dogwood-------1	Oak fern------------1	Canada white violet 2
	Yellow birch--------2	Yellow birch--------1	Alternateleaf		Canada mayflower-----2
	Eastern hemlock-----1	Northern red oak----1	dogwood------------1		Trout lily-----------2
	E. white pine-------1	E. white pine-------1	Witchhazel----------1		Grass spp.-----------2
	Quaking aspen-------1		American fly		Blue cohosh----------2
	Bigtooth aspen------1		honeysuckle--------1		Rosy twistedstalk----2
	Black cherry--------1				Trillium spp.--------2
	Northern red oak----1				Downy yellow violet--2
	White spruce--------1				Dutchmans breeches---2
					Starflower-----------2
					Hepatica spp.--------2
					Spring beauty--------2
					Baneberry spp.-------1
					Dewberry spp.--------1
					Currant/gooseberry---1
					Yellow beadlily------1
					Largeleaf aster------1
					Aster spp.-----------1
					Jack-in-the-pulpit---1
					Mint spp.------------1
					Solomons seal--------1
					False Solomons seal--1
					Hairy Solomons seal--1
					Bramble spp.---------1
					Wild sarsaparilla----1
					Wintergreen----------1
					Bearberry------------1
					Bunchberry-----------1
					Sedge spp.-----------1
401F------------------	Jack pine-----------5	Red maple-----------5	Canada yew----------2	Brackenfern---------2	Grass spp.-----------5
Lindquist sand,	Red maple-----------3	Yellow birch--------3			Lowbush blueberry----4
dissected	American beech------2	Northern red oak----3		Ground pine---------2	Currant/gooseberry---3
	Yellow birch--------2	American beech------2			Trillium spp.--------3
	Black cherry--------2	Black cherry--------2			Sweetfern------------3
	Hophornbeam---------2	Eastern hemlock-----2			Reindeer lichen------3
	Eastern hemlock-----2				Wood lily spp.-------2
	Quaking aspen-------1				Wintergreen----------2
	Red pine------------1				Blue cladonia--------2
					Barren strawberry----1
					Indian paintbrush----1
					Sedge spp.-----------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
402B, 402C-----------	Red pine-----------5	Quaking aspen-------1		Brackenfern---------5	Grass spp.-----------3
Islandlake loamy sand	Quaking aspen-------3	Black cherry--------1			Bramble spp.---------3
	Black cherry--------2	Sugar maple---------1			Sedge spp.-----------2
	Sugar maple---------2	E. white pine-------1			Reindeer lichen------2
	E. white pine-------2				Wintergreen----------1
					Lowbush blueberry-----------1
					Cinquefoil spp.------1
					Mint spp.------------1
					Sweetfern------------1
424B, 424C-----------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----2	Brackenfern---------2	Sweet cicely---------3
Morganlake-Ossineke-Blue Lake complex	American basswood---3	American basswood---2	Red elderberry------2	Shield fern---------2	Smooth yellow violet 3
	American beech------2	American beech------2	Alternateleaf dogwood-----------2	Rattlesnake fern----2	Wild leek------------3
	Bigtooth aspen------2	Yellow birch--------2	Silky dogwood-------1	Maidenhair fern-----2	Bedstraw spp.--------3
	Yellow birch--------2	Hophornbeam---------2	Mapleleaf viburnum 1	Oak fern------------1	Trout lily-----------3
	White ash-----------2	White ash-----------2	Witchhazel----------1	Cinnamon fern-------1	Canada white violet 2
	Hophornbeam---------2	Quaking aspen-------2			Canada mayflower-----2
	Quaking aspen-------2	Paper birch---------2			Grass spp.-----------2
	Northern red oak----2	Northern red oak----1			Largeleaf aster------2
	Black cherry--------1	Black cherry--------1			Rosy twistedstalk----2
	E. white pine-------1	Balsam fir----------1			Downy yellow violet 2
	White spruce--------1	E. white pine-------1			Currant/gooseberry---2
	Balsam fir----------1				Hepatica spp.--------2
	Eastern hemlock-----1				Miterwort spp.-------2
	Paper birch---------1				Dutchmans breeches---2
					Trillium spp.--------2
					Violet spp.----------2
					Wild sarsaparilla----2
					Spring beauty--------2
					False Solomons seal--2
					Mint spp.------------1
					Aster spp.-----------1
					Jack-in-the-pulpit---1
					Bramble spp.---------1
					Hairy Solomons seal--1
					Starflower-----------1
					Wintergreen----------1
					Bearberry------------1
					Yellow beadlily------1
					Bunchberry-----------1
					Solomons seal--------1
					Blue cohosh----------1
					Baneberry------------1
					Gay wings------------1
					Pyrola spp.----------1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
452D, 452E------------	Sugar maple---------5	Sugar maple---------3	Red elderberry------2	Maidenhair fern-----3	Trout lily-----------3
Bamfield fine sandy	American basswood---2	American beech------2	Serviceberry--------2	Shield fern---------2	Smooth yellow violet 3
loam, sandy	American beech------2	American basswood---2	Beaked hazelnut-----1		Wild leek------------3
substratum	Yellow birch--------2	White ash-----------2	American fly		Canada mayflower-----3
	Eastern hemlock-----2	Eastern hemlock-----2	honeysuckle--------1		Hepatica spp.--------3
	White ash-----------1	Hophornbeam---------1	Mapleleaf viburnum 1		Bedstraw spp.--------2
	Hophornbeam---------1	Northern red oak----1			Blue cohosh----------2
	E. white pine-------1	E. white pine-------1			Currant/gooseberry---2
					Dutchmans breeches---2
					Grass spp.-----------2
					Aster spp.-----------2
					Jack-in-the-pulpit---2
					Mint spp.------------2
					Rosy twistedstalk----2
					Starflower-----------2
					Sweet cicely---------2
					Trillium spp.--------2
					Downy yellow violet 2
					Yellow beadlily------1
					Largeleaf aster------1
					Solomons seal--------1
453B, 453C------------	Sugar maple---------5	Sugar maple---------3	Beaked hazelnut-----3	Shield fern---------3	Sweet cicely---------4
Ossineke fine sandy	American basswood---3	Yellow birch--------2		Rattlesnake fern----2	Smooth yellow violet 4
loam, sandy	American beech------2	White ash-----------2		Maidenhair fern-----1	Bedstraw spp.--------3
substratum	Bigtooth aspen------2	American basswood---2		Cinnamon fern-------1	Canada mayflower-----3
	Yellow birch--------2	Hophornbeam---------1			Grass spp.-----------3
	White ash-----------2				Trout lily-----------3
	Hophornbeam---------2				Canada white violet 3
					Wild leek------------3
					Baneberry spp.-------2
					Largeleaf aster------2
					Mint spp.------------2
					Rosy twistedstalk----2
					Sedge spp.-----------2
					Downy yellow violet 2
					Currant/gooseberry---2
					Hepatica spp.--------2
					Miterwort spp.-------2
					Dutchmans breeches---2
					Trillium spp.--------2
					Violet spp.----------2
					Wild sarsaparilla----2
					Aster spp.-----------2
					Jack-in-the-pulpit---1

See footnote at end of table.

Table 11.--Plant Communities on Selected Soils--Continued

Map symbol and soil name	Extent of major and minor trees	Extent of seedlings	Extent of shrubs	Extent of ferns and clubmoss	Extent of ground plants
463F-----------------	Sugar maple---------5	Sugar maple---------4	Witchhazel----------2	Brackenfern---------2	Sweet cicely---------3
Leelanau loamy sand,	Red maple-----------4	Red maple-----------3	Serviceberry--------2	Shield fern---------2	Canada mayflower-----3
dissected	American basswood---3	American basswood---2	Mapleleaf viburnum 1	Maidenhair fern-----1	Bedstraw spp.--------3
	Northern red oak----3	American beech------2	Striped maple-------1		Currant/gooseberry---2
	E. white pine-------3	White ash-----------2	Beaked hazelnut-----1	Running pine--------1	False Solomons seal--2
	Red pine------------3	Hophornbeam---------2			Rosy twistedstalk----2
	American beech------2				Downy yellow violet 2
	White ash-----------2				Grass spp.-----------2
	Hophornbeam---------2				Wild sarsaparilla----2
	Bigtooth aspen------2				Wintergreen----------2
	Paper birch---------1				Wild leek------------2
	Eastern hemlock-----1				Partridgeberry-------2
					Starflower-----------2
					Hairy Solomons seal--2
					Indianpipe-----------1
					Pyrolas spp.---------1
					Trillium spp.--------1
464B, 464C, 464D,					
464E----------------	Sugar maple---------5	Sugar maple---------3	Flowering dogwood---2	Maidenhair fern-----3	Wild leek------------3
Mossback sandy loam	American basswood---3	American beech------3	Red elderberry------2	Rattlesnake fern----2	Sweet cicely---------3
	American beech------2	White ash-----------3		Shield fern---------2	Trillium spp.--------3
	White ash-----------2	Yellow birch--------3			Trout lily-----------3
	Hophornbeam---------2	Hophornbeam---------2			Smooth yellow violet 3
	Yellow birch--------2	American basswood---2			Bedstraw spp.--------3
					Dutchmans breeches---3
					Spring beauty--------3
					Canada mayflower-----3
					False Solomons seal--2
					Grass spp.-----------2
					Miterwort spp.-------2
					Blue cohosh----------2
					Rosy twistedstalk----2
					Downy yellow violet 2
					Currant/gooseberry---2
					Gay wings------------2
					Jack-in-the-pulpit---2
					Hepatica spp.--------1
					Indianpipe-----------1

* This map unit is dominated by shrubs in some areas.

Table 12.--Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height on the soil.)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
13:					
Tawas	Common ninebark, redosier dogwood, silky dogwood.	Nannyberry, southern arrowwood, black spruce.	Northern white-cedar, green ash.	---	---
Lupton.					
14:					
Dawson.					
Loxley	Common ninebark, gray dogwood, silky dogwood.	American cranberrybush, common lilac, nannyberry.	Northern white-cedar.	Siberian crabapple, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
15A:					
Croswell	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
Au Gres	Common ninebark	American cranberrybush, Amur maple, nannyberry.	White spruce	Manchurian crabapple, Norway spruce, jack pine, eastern white pine, green ash.	Imperial Carolina poplar.
16B:					
Graycalm	Siberian peashrub	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
17A, 17B:					
Croswell	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
18A:					
Au Gres	Common ninebark	American cranberrybush, Amur maple, nannyberry.	White spruce	Manchurian crabapple, Norway spruce, jack pine, eastern white pine, green ash.	Imperial Carolina poplar.
19:					
Leafriver.					
20B, 20D, 20F:					
Graycalm	Siberian peashrub	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
20B, 20D, 20F:					
Grayling	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
23:					
Ausable.					
Bowstring.					
24A:					
Kinross	American cranberrybush, common ninebark, silky dogwood.	Common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce, Norway spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
Au Gres	Common ninebark	American cranberrybush, Amur maple, nannyberry.	White spruce	Manchurian crabapple, Norway spruce, jack pine, eastern white pine, green ash.	Imperial Carolina poplar.
25B, 25C:					
Kent	Common ninebark, silky dogwood.	American cranberrybush, common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce, Norway spruce, eastern white pine.	Green ash, red maple.	---
28B, 28C, 28E:					
East Lake	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
32B:					
Kellogg	American cranberrybush, Roselow sargent crabapple, Siberian peashrub, silky dogwood.	Common lilac, Amur maple, eastern redcedar.	Manchurian crabapple, white spruce, Norway spruce.	Eastern white pine, red pine.	---
33B, 33C, 33D, 33E:					
Mancelona	Siberian peashrub	Common lilac, Amur maple, eastern redcedar, northern white-cedar.	Manchurian crabapple, white spruce, Norway spruce.	Eastern white pine, jack pine, red pine.	Imperial Carolina poplar.
47D, 47F:					
Graycalm	Siberian peashrub	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
49B:					
Kalkaska	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
50B:					
Au Gres	Common ninebark	American cranberrybush, Amur maple, nannyberry.	White spruce	Manchurian crabapple, Norway spruce, jack pine, eastern white pine, green ash.	Imperial Carolina poplar.
Kinross	American cranberrybush, common ninebark, silky dogwood.	Common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce, Norway spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
Croswell	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
51:					
Tawas	Common ninebark, redosier dogwood, silky dogwood.	Nannyberry, southern arrowwood, black spruce.	Northern white-cedar, green ash.	---	---
Leafriver.					
52B, 52D, 52E:					
Blue Lake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Austrian pine, jack pine, red pine, eastern white pine.	---	---
64B:					
Feldhauser	Siberian peashrub	Common lilac, Manchurian crabapple, eastern redcedar, northern white-cedar.	White spruce, Austrian pine, Norway spruce.	Eastern white pine, red pine.	Imperial Carolina poplar.

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
65F, 75B, 75D, 75E:					
Rubicon----------	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
78:					
Pits, borrow.					
81B, 81D, 81E, 81F:					
Grayling----------	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
82B:					
Udorthents.					
83B:					
Udipsamments.					
86:					
Histosols.					
Aquents.					
90B:					
Chinwhisker-------	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
95D, 95E:					
Menominee---------	Common lilac, sargent crabapple.	Amur maple, eastern redcedar, nannyberry.	Siberian crabapple, white spruce, Norway spruce.	Eastern white pine, green ash, red pine.	Imperial Carolina poplar.
113:					
Angelica.					
115D:					
Kalkaska----------	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
116B:					
Mancelona	Siberian peashrub	Common lilac, Amur maple, eastern redcedar, northern white-cedar.	Manchurian crabapple, white spruce, Norway spruce.	Eastern white pine, jack pine, red pine.	Imperial Carolina poplar.
126F:					
Udipsamments.					
Haplorthods.					
Glossudalfs.					
127:					
Cathro.					
141B, 141C, 141D:					
Leelanau	Common ninebark, silky dogwood.	Common lilac, eastern redcedar, southern arrowwood.	Siberian crabapple, white spruce, Norway spruce.	Eastern white pine, green ash, red pine.	Imperial Carolina poplar.
146F:					
Rubicon	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
Graycalm	Siberian peashrub	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
147B, 147C, 147D, 147E:					
Lindquist	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
166A:					
Slade	Roselow sargent crabapple, silky dogwood.	American cranberrybush, common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce	Manchurian crabapple, eastern white pine, green ash.	Imperial Carolina poplar.

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
197A:					
Gladwin	Roselow sargent crabapple, silky dogwood.	American cranberrybush, common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce	Manchurian crabapple, eastern white pine, green ash.	Imperial Carolina poplar.
323B, 323C:					
East Lake	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
Rubicon	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
337B, 337C:					
Mancelona	Siberian peashrub	Common lilac, Amur maple, eastern redcedar, northern white-cedar.	Manchurian crabapple, white spruce, Norway spruce.	Eastern white pine, jack pine, red pine.	Imperial Carolina poplar.
East Lake	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
338B, 338C, 338D:					
Islandlake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
347F:					
Kalkaska	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
349B:					
Hartwick	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
350D:					
Blue Lake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Austrian pine, jack pine, red pine, eastern white pine.	---	---
352B:					
Deford	American cranberrybush, common ninebark, silky dogwood.	Common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce, Norway spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
Au Gres	Common ninebark	American cranberrybush, Amur maple, nannyberry.	White spruce	Manchurian crabapple, Norway spruce, jack pine, eastern white pine, green ash.	Imperial Carolina poplar.
Croswell	Siberian peashrub, manyflower cotoneaster.	Amur maple, common lilac, eastern redcedar.	Jack pine, red pine.	Eastern white pine.	---
354F:					
Mancelona	Siberian peashrub	Common lilac, Amur maple, eastern redcedar, northern white-cedar.	Manchurian crabapple, white spruce, Norway spruce.	Eastern white pine, jack pine, red pine.	Imperial Carolina poplar.
Blue Lake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Austrian pine, jack pine, red pine, eastern white pine.	---	---
360:					
Wakeley	Common ninebark, redosier dogwood, silky dogwood.	Nannyberry, southern arrowwood, black spruce.	Northern white-cedar, green ash.	---	---
362D:					
Millersburg	Siberian peashrub	Common lilac, nannyberry, southern arrowwood.	Siberian crabapple, eastern redcedar, white spruce.	Austrian pine, Norway spruce, red pine, eastern white pine.	Imperial Carolina poplar.

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
365F:					
Blue Lake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Austrian pine, jack pine, red pine, eastern white pine.	---	---
368A:					
Au Gres	Common ninebark	American cranberrybush, Amur maple, nannyberry.	White spruce	Manchurian crabapple, Norway spruce, jack pine, eastern white pine, green ash.	Imperial Carolina poplar.
Deford	American cranberrybush, common ninebark, silky dogwood.	Common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce, Norway spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
369:					
Deford	American cranberrybush, common ninebark, silky dogwood.	Common lilac, Amur maple, nannyberry, northern white-cedar.	White spruce, Norway spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
380:					
Access denied.					
387F:					
Mancelona	Siberian peashrub	Common lilac, Amur maple, eastern redcedar, northern white-cedar.	Manchurian crabapple, white spruce, Norway spruce.	Eastern white pine, jack pine, red pine.	Imperial Carolina poplar.
Rubicon	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
393B, 393C:					
Morganlake	American cranberrybush.	Common lilac, eastern redcedar, nannyberry, northern white-cedar.	Manchurian crabapple, Black Hills spruce, white spruce, Norway spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
399D, 400F:					
Menominee	Common lilac, sargent crabapple.	Amur maple, eastern redcedar, nannyberry.	Siberian crabapple, white spruce, Norway spruce.	Eastern white pine, green ash, red pine.	Imperial Carolina poplar.

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
399D, 400F:					
Bamfield	Roselow sargent crabapple, Siberian peashrub.	American cranberrybush, common lilac, northern white-cedar.	Blue spruce, white spruce, Austrian pine.	Manchurian crabapple, Norway spruce, green ash.	Imperial Carolina poplar.
Blue Lake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Austrian pine, jack pine, red pine, eastern white pine.	---	---
401F:					
Lindquist	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
402B, 402C, 402D:					
Islandlake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Jack pine, red pine, eastern white pine.	---	---
424B, 424C:					
Morganlake	American cranberrybush.	Common lilac, eastern redcedar, nannyberry, northern white-cedar.	Manchurian crabapple, Black Hills spruce, white spruce, Norway spruce.	Eastern white pine, green ash.	Imperial Carolina poplar.
Ossineke	Roselow sargent crabapple, Siberian peashrub.	American cranberrybush, common lilac, northern white-cedar.	Blue spruce, white spruce, Austrian pine.	Manchurian crabapple, Norway spruce, green ash.	Imperial Carolina poplar.
Blue Lake	Peking cotoneaster, Siberian peashrub, barberry, common lilac, silver buffaloberry, smooth sumac, staghorn sumac.	Eastern redcedar	Austrian pine, jack pine, red pine, eastern white pine.	---	---

Table 12.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
452D, 452E:					
Bamfield	Roselow sargent crabapple, Siberian peashrub.	American cranberrybush, common lilac, northern white-cedar.	Blue spruce, white spruce, Austrian pine.	Manchurian crabapple, Norway spruce, green ash.	Imperial Carolina poplar.
453B, 453C:					
Ossineke	Roselow sargent crabapple, Siberian peashrub.	American cranberrybush, common lilac, northern white-cedar.	Austrian pine, blue spruce, white spruce.	Manchurian crabapple, Norway spruce, white ash.	Imperial Carolina poplar.
463F:					
Leelanau	Common ninebark, silky dogwood.	Common lilac, eastern redcedar, southern arrowwood.	Siberian crabapple, white spruce, Norway spruce.	Eastern white pine, green ash, red pine.	Imperial Carolina poplar.
464B, 464C, 464D, 464E:					
Mossback	Roselow sargent crabapple, Siberian crabapple.	Siberian peashrub, common lilac, nannyberry, southern arrowwood.	Eastern redcedar, white spruce.	Austrian pine, Norway spruce, red pine, eastern white pine.	Imperial Carolina poplar.
465:					
Caffey	Common ninebark, redosier dogwood, silky dogwood.	Nannyberry, southern arrowwood, black spruce.	Northern white-cedar, green ash.	---	---

Table 13.--Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
13:					
Tawas	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Lupton	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
14:					
Dawson	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Loxley	Severe: excess humus, ponding, too acid.	Severe: excess humus, ponding, too acid.	Severe: excess humus, ponding, too acid.	Severe: excess humus, ponding.	Severe: excess humus, ponding, too acid.
15A:					
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
16B:					
Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
17A:					
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
17B:					
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
18A:					
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
19:					
Leafriver	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
20B:					
Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
Grayling	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
20D:					
Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
Grayling	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.
20F:					
Graycalm	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
Grayling	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope, too acid.
23:					
Ausable	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.	Severe: excess humus, ponding.	Severe: excess humus, flooding, ponding.
Bowstring	Severe: excess humus, flooding, wetness.	Severe: excess humus, wetness.	Severe: excess humus, flooding, wetness.	Severe: excess humus, wetness.	Severe: excess humus, flooding, wetness.
24A:					
Kinross	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding.
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
25B:					
Kent	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight	Moderate: wetness.
25C:					
Kent	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Slight	Moderate: slope, wetness.
28B:					
East Lake	Severe: too sandy.	Severe: too sandy.	Moderate: slope, small stones.	Severe: too sandy.	Moderate: droughty, large stones.
28C:					
East Lake	Severe: too sandy.	Severe: too sandy.	Severe: slope.	Severe: too sandy.	Moderate: droughty, large stones, slope.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
28E:					
East Lake	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.	Severe: too sandy.	Severe: slope.
32B:					
Kellogg	Severe: percs slowly, too sandy.	Severe: percs slowly, too sandy.	Severe: percs slowly, too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
33B:					
Mancelona	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty, large stones.
33C:					
Mancelona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, large stones, slope.
33D:					
Mancelona	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
33E:					
Mancelona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
47D:					
Graycalm	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
47F:					
Graycalm	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
49B:					
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
50B:					
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
Kinross	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding.
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
51:					
Tawas	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
51:					
Leafriver	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
52B:					
Blue Lake	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
52D:					
Blue Lake	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
52E:					
Blue Lake	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
64B:					
Feldhauser	Slight	Slight	Moderate: slope.	Slight	Slight.
65F:					
Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
75B:					
Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
75D:					
Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
75E:					
Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
78:					
Pits, borrow.					
81B:					
Grayling	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.
81D:					
Grayling	Severe: too acid, too sandy.	Severe: too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: too sandy.	Severe: droughty, too acid.
81E:					
Grayling	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope, too acid.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
81F:					
Grayling	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too acid, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope, too acid.
82B:					
Udorthents	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.
83B:					
Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
86:					
Histosols	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.
Aquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
90B:					
Chinwhisker	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
95D:					
Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy.	Severe: slope.
95E:					
Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy.	Severe: slope.
113:					
Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
115D:					
Kalkaska	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
116B:					
Mancelona	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty, large stones.
126F:					
Udipsamments	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
Haplorthods	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Glossudalfs	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
127:					
Cathro	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
141B:					
Leelanau	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty, large stones.
141C:					
Leelanau	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, large stones, slope.
141D:					
Leelanau	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
146F:					
Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
Graycalm	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.
147B:					
Lindquist	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
147C:					
Lindquist	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
147D:					
Lindquist	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
147E:					
Lindquist	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
166A:					
Slade	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: large stones, wetness.
197A:					
Gladwin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
323B:					
East Lake	Severe: too sandy.	Severe: too sandy.	Moderate: slope, small stones.	Severe: too sandy.	Moderate: droughty, large stones.
Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
323C:					
East Lake	Severe: too sandy.	Severe: too sandy.	Severe: slope.	Severe: too sandy.	Moderate: droughty, large stones, slope.
Rubicon	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: droughty.
337B:					
Mancelona	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty, large stones.
East Lake	Severe: too sandy.	Severe: too sandy.	Moderate: slope, small stones.	Severe: too sandy.	Moderate: droughty, large stones.
337C:					
Mancelona	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, large stones, slope.
East Lake	Severe: too sandy.	Severe: too sandy.	Severe: slope.	Severe: too sandy.	Moderate: droughty, large stones, slope.
338B:					
Islandlake	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
338C:					
Islandlake	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
338D:					
Islandlake	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
347F:					
Kalkaska	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
349B:					
Hartwick	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
350D:					
Blue Lake	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
352B:					
Deford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
Croswell	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, too sandy.
354F:					
Mancelona	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
Blue Lake	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
360:					
Wakeley	Severe: excess humus, percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: percs slowly, ponding.	Severe: ponding.	Severe: excess humus, ponding.
362D:					
Millersburg	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, large stones, slope.
365F:					
Blue Lake	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
368A:					
Au Gres	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: too sandy, wetness.	Severe: wetness.
Deford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
369:					
Deford	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus,
380:					
Access denied.					
387F:					
Mancelona	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
Rubicon	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: droughty, slope.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
393B:					
Morganlake	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid.
393C:					
Morganlake	Severe: too acid.	Severe: too acid.	Severe: slope, too acid.	Moderate: too sandy.	Severe: too acid.
399D:					
Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy.	Severe: slope.
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Blue Lake	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.	Severe: slope.
400F:					
Menominee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Blue Lake	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
401F:					
Lindquist	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope.
402B:					
Islandlake	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
402C:					
Islandlake	Moderate: droughty, slope.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
402D:					
Islandlake	Severe: slope.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Severe: slope.
424B:					
Morganlake	Severe: too acid.	Severe: too acid.	Severe: too acid.	Moderate: too sandy.	Severe: too acid.
Ossineke	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
Blue Lake	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.

Table 13.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
424C:					
Morganlake	Severe: too acid.	Severe: too acid.	Severe: slope, too acid.	Moderate: too sandy.	Severe: too acid.
Ossineke	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Moderate: wetness.	Moderate: slope, wetness.
Blue Lake	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
452D:					
Bamfield	Severe: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
452E:					
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
453B:					
Ossineke	Moderate: slope, wetness.	Moderate: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: wetness.
453C:					
Ossineke	Moderate: slope, wetness.	Moderate: slope, wetness.	Severe: slope.	Moderate: wetness.	Moderate: slope, wetness.
463F:					
Leelanau	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
464B:					
Mossback	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: large stones.
464C:					
Mossback	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope.
464D:					
Mossback	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
464E:					
Mossback	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
465:					
Caffey	Severe: ponding.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: ponding.

Table 14.--Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
13:										
Tawas	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Lupton	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
14:										
Dawson	Very poor.	Poor	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
Loxley	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
15A:										
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
16B:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
17A:										
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
17B:										
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
18A:										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
19:										
Leafriver	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
20B:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Grayling	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
20D:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Grayling	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
20F:										
Graycalm	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
Grayling	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
23:										
Ausable	Very poor.	Poor	Poor	Poor	Poor	Fair	Good	Poor	Poor	Fair.
Bowstring	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
24A:										
Kinross	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
25B:										
Kent	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
25C:										
Kent	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
28B:										
East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
28C:										
East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
28E:										
East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
32B:										
Kellogg	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
33B:										
Mancelona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
33C:										
Mancelona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
33D:										
Mancelona	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
33E:										
Mancelona	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
47D:										
Graycalm	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
47F:										
Graycalm	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
49B:										
Kalkaska----------	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
50B:										
Au Gres-----------	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
Kinross-----------	Very poor.	Poor	Poor	Fair	Fair	Good	Good	Very poor.	Fair	Good.
Croswell----------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
51:										
Tawas-------------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Leafriver---------	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
52B:										
Blue Lake---------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
52D:										
Blue Lake---------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
52E:										
Blue Lake---------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
64B:										
Feldhauser--------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
65F:										
Rubicon-----------	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
75B:										
Rubicon-----------	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
75D:										
Rubicon-----------	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
75E:										
Rubicon-----------	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
78:										
Pits, borrow.										
81B:										
Grayling----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
81D:										
Grayling----------	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
81E:										
Grayling----------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
81F:										
Grayling----------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
82B:										
Udorthents.										
83B:										
Udipsamments.										
86:										
Histosols.										
Aquents.										
90B:										
Chinwhisker-------	Poor	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
95D:										
Menominee---------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
95E:										
Menominee---------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
113:										
Angelica----------	Good	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
115D:										
Kalkaska----------	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
116B:										
Mancelona---------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
126F:										
Udipsamments.										
Haplorthods.										
Glossudalfs.										
127:										
Cathro------------	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
141B:										
Leelanau----------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
141C:										
Leelanau----------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
141D:										
Leelanau	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
146F:										
Rubicon	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Graycalm	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
147B:										
Lindquist	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
147C:										
Lindquist	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
147D:										
Lindquist	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
147E:										
Lindquist	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
166A:										
Slade	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
197A:										
Gladwin	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
323B:										
East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rubicon	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
323C:										
East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Rubicon	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
337B:										
Mancelona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
337C:										
Mancelona	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
East Lake	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
338B:										
Islandlake	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
338C:										
Islandlake	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
338D:										
Islandlake	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
347F:										
Kalkaska	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
349B:										
Hartwick	Poor	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
350D:										
Blue Lake	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
352B:										
Deford	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
Croswell	Poor	Poor	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
354F:										
Mancelona	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Blue Lake	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
360:										
Wakeley	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
362D:										
Millersburg	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
365F:										
Blue Lake	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
368A:										
Au Gres	Poor	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
Deford	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
369:										
Deford	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
380:										
Access denied.										

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
387F:										
Mancelona	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Rubicon	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
393B:										
Morganlake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
393C:										
Morganlake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
399D:										
Menominee	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bamfield	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Blue Lake	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
400F:										
Menominee	Poor	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bamfield	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Blue Lake	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
401F:										
Lindquist	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
402B:										
Islandlake	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
402C:										
Islandlake	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
402D:										
Islandlake	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
424B:										
Morganlake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ossineke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Blue Lake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

Table 14.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
424C:										
Morganlake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ossineke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Blue Lake	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
452D:										
Bamfield	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
452E:										
Bamfield	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
453B:										
Ossineke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
453C:										
Ossineke	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
463F:										
Leelanau	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
464B:										
Mossback	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
464C:										
Mossback	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
464D:										
Mossback	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
464E:										
Mossback	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
465:										
Caffey	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.

Table 15.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
13:						
Tawas	Severe: cutbanks cave, excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
Lupton	Severe: excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
14:						
Dawson	Severe: cutbanks cave, excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
Loxley	Severe: excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding, too acid.
15A:						
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
16B:						
Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
17A:						
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
17B:						
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
18A:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
19:						
Leafriver	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: excess humus, ponding.
20B:						
Graycalm	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
20B:						
Grayling	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty, too acid.
20D:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty, too acid.
20F:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope, too acid.
23:						
Ausable	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: excess humus, flooding, ponding.
Bowstring	Severe: cutbanks cave, excess humus, wetness.	Severe: flooding, subsides, wetness.	Severe: flooding, subsides, wetness.	Severe: flooding, subsides, wetness.	Severe: flooding, subsides, wetness.	Severe: excess humus, flooding, wetness.
24A:						
Kinross	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
25B:						
Kent	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
25C:						
Kent	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, wetness.
28B:						
East Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
28C:						
East Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, large stones, slope.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
28E:						
East Lake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
32B:						
Kellogg	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Slight	Moderate: droughty, too sandy.
33B:						
Mancelona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
33C:						
Mancelona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, large stones, slope.
33D:						
Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
33E:						
Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
47D:						
Graycalm	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
47F:						
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
49B:						
Kalkaska	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
50B:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Kinross	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
51:						
Tawas	Severe: cutbanks cave, excess humus, ponding.	Severe: low strength, ponding, subsides.	Severe: ponding, subsides.	Severe: low strength, ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
51:						
Leafriver	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: excess humus, ponding.
52B:						
Blue Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
52D:						
Blue Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
52E:						
Blue Lake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
64B:						
Feldhauser	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
65F:						
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
75B:						
Rubicon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
75D:						
Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
75E:						
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
78:						
Pits, borrow.						
81B:						
Grayling	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty, too acid.
81D:						
Grayling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty, too acid.
81E:						
Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope, too acid.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
81F:						
Grayling	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope, too acid.
82B:						
Udorthents	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.
83B:						
Udipsamments	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
86:						
Histosols	Severe: excess humus, ponding.	Severe: low strength, ponding.	Severe: ponding.	Severe: low strength, ponding.	Severe: frost action, ponding.	Severe: excess humus, ponding.
Aquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
90B:						
Chinwhisker	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
95D:						
Menominee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
95E:						
Menominee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
113:						
Angelica	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: frost action, ponding.	Severe: ponding.
115D:						
Kalkaska	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
116B:						
Mancelona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
126F:						
Udipsamments	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Haplorthods	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
126F:						
Glossudalfs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
127:						
Cathro	Severe: excess humus, ponding.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: ponding, subsides.	Severe: frost action, ponding, subsides.	Severe: excess humus, ponding.
141B:						
Leelanau	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
141C:						
Leelanau	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, large stones, slope.
141D:						
Leelanau	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
146F:						
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Graycalm	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
147B:						
Lindquist	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
147C:						
Lindquist	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
147D:						
Lindquist	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
147E:						
Lindquist	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
166A:						
Slade	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: large stones, wetness.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
197A:						
Gladwin	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
323B:						
East Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
Rubicon	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
323C:						
East Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, large stones, slope.
Rubicon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
337B:						
Mancelona	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
East Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, large stones.
337C:						
Mancelona	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, large stones, slope.
East Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, large stones, slope.
338B:						
Islandlake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
338C:						
Islandlake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
338D:						
Islandlake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
347F:						
Kalkaska	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
349B:						
Hartwick	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
350D:						
Blue Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
352B:						
Deford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Croswell	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
354F:						
Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Blue Lake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
360:						
Wakeley	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
362D:						
Millersburg	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope.	Moderate: droughty, large stones, slope.
365F:						
Blue Lake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
368A:						
Au Gres	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Deford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.
369:						
Deford	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: excess humus, ponding.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
380:						
Access denied.						
387F:						
Mancelona	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rubicon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
393B:						
Morganlake	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: too acid.
393C:						
Morganlake	Severe: cutbanks cave, wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, wetness.	Severe: too acid.
399D:						
Menominee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Blue Lake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
400F:						
Menominee	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Blue Lake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
401F:						
Lindquist	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
402B:						
Islandlake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
402C:						
Islandlake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
402D:						
Islandlake	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
424B:						
Morganlake	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: too acid.
Ossineke	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, wetness.	Moderate: low strength, shrink-swell, wetness.	Moderate: wetness.
Blue Lake	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
424C:						
Morganlake	Severe: cutbanks cave, wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, wetness.	Severe: too acid.
Ossineke	Severe: wetness.	Moderate: shrink-swell, slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: low strength, shrink-swell, wetness.	Moderate: slope, wetness.
Blue Lake	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
452D:						
Bamfield	Severe: slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Moderate: slope.
452E:						
Bamfield	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
453B:						
Ossineke	Severe: wetness.	Moderate: shrink-swell, wetness.	Severe: wetness.	Moderate: shrink-swell, slope, wetness.	Moderate: low strength, shrink-swell, wetness.	Moderate: wetness.
453C:						
Ossineke	Severe: wetness.	Moderate: shrink-swell, slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: low strength, shrink-swell, wetness.	Moderate: slope, wetness.
463F:						
Leelanau	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
464B:						
Mossback	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: large stones.

Table 15.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
464C:						
Mossback-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, slope.	Moderate: large stones, slope.
464D:						
Mossback-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
464E:						
Mossback-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
465:						
Caffey-------------	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.

Table 16.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
13:					
Tawas	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Lupton	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage.	Poor: excess humus, ponding.
14:					
Dawson	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage.	Poor: excess humus, ponding.
Loxley	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage.	Poor: excess humus, ponding, too acid.
15A:					
Croswell	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Au Gres	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
16B:					
Graycalm	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17A:					
Croswell	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
17B:					
Croswell	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
18A:					
Au Gres	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
19:					
Leafriver	Severe:	Severe:	Severe:	Severe:	Poor:
	ponding,	excess humus,	ponding,	ponding,	ponding,
	poor filter.	ponding,	seepage,	seepage.	seepage,
		seepage.	too sandy.		too sandy.
20B:					
Graycalm	Severe:	Severe:	Severe:	Severe:	Poor:
	poor filter.	seepage.	seepage,	seepage.	seepage,
			too sandy.		too sandy.
Grayling	Severe:	Severe:	Severe:	Severe:	Poor:
	poor filter.	seepage.	seepage,	seepage.	seepage,
			too sandy.		too sandy.
20D:					
Graycalm	Severe:	Severe:	Severe:	Severe:	Poor:
	poor filter.	seepage,	seepage,	seepage.	seepage,
		slope.	too sandy.		too sandy.
Grayling	Severe:	Severe:	Severe:	Severe:	Poor:
	poor filter.	seepage,	seepage,	seepage.	seepage,
		slope.	too sandy.		too sandy.
20F:					
Graycalm	Severe:	Severe:	Severe:	Severe:	Poor:
	poor filter,	seepage,	seepage,	seepage,	seepage,
	slope.	slope.	slope,	slope.	slope,
			too sandy.		too sandy.
Grayling	Severe:	Severe:	Severe:	Severe:	Poor:
	poor filter,	seepage,	seepage,	seepage,	seepage,
	slope.	slope.	slope,	slope.	slope,
			too sandy.		too sandy.
23:					
Ausable	Severe:	Severe:	Severe:	Severe:	Poor:
	flooding,	excess humus,	flooding,	flooding,	ponding,
	ponding,	flooding,	ponding,	ponding,	seepage,
	poor filter.	seepage.	seepage.	seepage.	too sandy.
Bowstring	Severe:	Severe:	Severe:	Severe:	Poor:
	flooding,	excess humus,	flooding,	flooding,	excess humus,
	percs slowly,	flooding,	seepage,	seepage,	wetness.
	wetness.	seepage.	wetness.	wetness.	
24A:					
Kinross	Severe:	Severe:	Severe:	Severe:	Poor:
	ponding,	ponding,	ponding,	ponding,	ponding,
	poor filter.	seepage.	seepage,	seepage.	seepage,
			too sandy.		too sandy.
Au Gres	Severe:	Severe:	Severe:	Severe:	Poor:
	poor filter,	seepage,	seepage,	seepage,	seepage,
	wetness.	wetness.	too sandy,	wetness.	too sandy,
			wetness.		wetness.
25B:					
Kent	Severe:	Moderate:	Severe:	Moderate:	Poor:
	percs slowly,	slope.	too clayey.	wetness.	hard to pack,
	wetness.				too clayey.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
25C:					
Kent	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: slope, wetness.	Poor: hard to pack, too clayey.
28B:					
East Lake	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
28C:					
East Lake	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
28E:					
East Lake	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.
32B:					
Kellogg	Severe: percs slowly, poor filter, wetness.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: hard to pack, too clayey.
33B:					
Mancelona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
33C:					
Mancelona	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
33D:					
Mancelona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.
33E:					
Mancelona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.
47D:					
Graycalm	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
47F:					
Graycalm	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
49B:					
Kalkaska	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
50B:					
Au Gres	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Kinross	Severe: ponding, poor filter.	Severe: ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Croswell	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
51:					
Tawas	Severe: percs slowly, ponding, subsides.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Leafriver	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
52B:					
Blue Lake	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
52D:					
Blue Lake	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
52E:					
Blue Lake	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
64B:					
Feldhauser	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
65F:					
Rubicon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
75B:					
Rubicon	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
75D:					
Rubicon------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
75E:					
Rubicon------------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
78:					
Pits, borrow.					
81B:					
Grayling-----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
81D:					
Grayling-----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
81E:					
Grayling-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
81F:					
Grayling-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
82B:					
Udorthents---------	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.
83B:					
Udipsamments-------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
86:					
Histosols----------	Severe: ponding.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding.	Poor: excess humus, ponding.
Aquents------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
90B:					
Chinwhisker--------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
95D:					
Menominee----------	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
95E:					
Menominee	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
113:					
Angelica	Severe: percs slowly, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, small stones.
115D:					
Kalkaska	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
116B:					
Mancelona	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
126F:					
Udipsamments	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Haplorthods	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Glossudalfs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
127:					
Cathro	Severe: percs slowly, ponding.	Severe: excess humus, ponding, seepage.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding.
141B:					
Leelanau	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
141C:					
Leelanau	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: seepage.
141D:					
Leelanau	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
146F:					
Rubicon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
Graycalm	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
147B:					
Lindquist----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
147C:					
Lindquist----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
147D:					
Lindquist----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
147E:					
Lindquist----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
166A:					
Slade--------------	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
197A:					
Gladwin------------	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, small stones, too sandy.
323B:					
East Lake----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
Rubicon------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
323C:					
East Lake----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
Rubicon------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
337B:					
Mancelona----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
East Lake----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
337C:					
Mancelona	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
East Lake	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, small stones, too sandy.
338B:					
Islandlake	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
338C:					
Islandlake	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
338D:					
Islandlake	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
347F:					
Kalkaska	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
349B:					
Hartwick	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
350D:					
Blue Lake	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
352B:					
Deford	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
Au Gres	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Croswell	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy.
354F:					
Mancelona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
354F:					
Blue Lake	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
360:					
Wakeley	Severe: percs slowly, ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, too clayey.	Severe: ponding, seepage.	Poor: hard to pack, ponding, too clayey.
362D:					
Millersburg	Moderate: percs slowly, slope.	Severe: seepage, slope.	Moderate: slope.	Severe: seepage.	Poor: thin layer.
365F:					
Blue Lake	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
368A:					
Au Gres	Severe: poor filter, wetness.	Severe: seepage, wetness.	Severe: seepage, too sandy, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Deford	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
369:					
Deford	Severe: ponding, poor filter.	Severe: excess humus, ponding, seepage.	Severe: ponding, seepage, too sandy.	Severe: ponding, seepage.	Poor: ponding, seepage, too sandy.
380:					
Access denied.					
387F:					
Mancelona	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, small stones, too sandy.
Rubicon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
393B:					
Morganlake	Severe: percs slowly, poor filter, wetness.	Severe: seepage, wetness.	Severe: too acid.	Severe: seepage.	Fair: too clayey, wetness.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
393C:					
Morganlake----------	Severe: percs slowly, poor filter, wetness.	Severe: seepage, slope, wetness.	Severe: too acid.	Severe: seepage.	Fair: slope, too clayey, wetness.
399D:					
Menominee-----------	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
Bamfield------------	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
Blue Lake-----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
400F:					
Menominee-----------	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
Bamfield------------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: seepage, slope.	Poor: slope.
Blue Lake-----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
401F:					
Lindquist-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
402B:					
Islandlake----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
402C:					
Islandlake----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
402D:					
Islandlake----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope, too sandy.
424B:					
Morganlake----------	Severe: percs slowly, poor filter, wetness.	Severe: seepage, wetness.	Severe: too acid.	Severe: seepage.	Fair: too clayey, wetness.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
424B:					
Ossineke-----------	Severe: percs slowly, wetness.	Moderate: seepage, slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
Blue Lake----------	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
424C:					
Morganlake---------	Severe: percs slowly, poor filter, wetness.	Severe: seepage, slope, wetness.	Severe: too acid.	Severe: seepage.	Fair: slope, too clayey, wetness.
Ossineke-----------	Severe: wetness.	Severe: slope, wetness.	Severe: seepage, wetness.	Moderate: slope, wetness.	Fair: slope, wetness.
Blue Lake----------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
452D:					
Bamfield-----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: slope, too clayey.
452E:					
Bamfield-----------	Severe: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
453B:					
Ossineke-----------	Severe: wetness.	Severe: wetness.	Severe: seepage, wetness.	Moderate: slope, wetness.	Fair: slope, wetness.
453C:					
Ossineke-----------	Severe: wetness.	Severe: slope, wetness.	Severe: seepage, wetness.	Moderate: slope, wetness.	Fair: slope, wetness.
463F:					
Leelanau-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: seepage, slope.
464B:					
Mossback-----------	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
464C:					
Mossback-----------	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope, small stones.
464D:					
Mossback-----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.

Table 16.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
464E:					
Mossback-----------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
465:					
Caffey-------------	Severe: percs slowly, ponding.	Severe: ponding, seepage.	Severe: ponding.	Severe: ponding, seepage.	Poor: ponding.

Table 17.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
13:				
Tawas	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Lupton	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
14:				
Dawson	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Loxley	Poor: low strength, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, too acid, wetness.
15A:				
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
16B:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
17A:				
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
17B:				
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
18A:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
19:				
Leafriver	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
20B:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
20D:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
20F:				
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
Grayling	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
23:				
Ausable	Poor: wetness.	Probable	Improbable: too sandy.	Poor: small stones, too sandy, wetness.
Bowstring	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
24A:				
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
25B:				
Kent	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
25C:				
Kent	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
28B:				
East Lake	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
28C:				
East Lake	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
28E:				
East Lake	Fair: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
32B:				
Kellogg	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
33B:				
Mancelona	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
33C:				
Mancelona	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
33D:				
Mancelona	Fair: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
33E:				
Mancelona	Poor: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
47D:				
Graycalm	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
47F:				
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
49B:				
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
50B:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Kinross	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
51:				
Tawas	Poor: wetness.	Probable	Improbable: too sandy.	Poor: excess humus, wetness.
Leafriver	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
52B:				
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
52D:				
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
52E:				
Blue Lake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
64B:				
Feldhauser	Good	Probable	Improbable: too sandy.	Good.
65F:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
75B:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
75D:				
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
75E:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
78:				
Pits, borrow.				
81B:				
Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
81D:				
Grayling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
81E:				
Grayling	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
81F:				
Grayling	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
82B:				
Udorthents	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.
83B:				
Udipsamments	Good	Probable	Improbable: too sandy.	Poor: too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
86:				
Histosols	Poor: low strength, wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Aquents	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
90B:				
Chinwhisker	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
95D:				
Menominee	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
95E:				
Menominee	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
113:				
Angelica	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, wetness.
115D:				
Kalkaska	Good	Probable	Improbable: too sandy.	Poor: too sandy.
116B:				
Mancelona	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
126F:				
Udipsamments	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Haplorthods	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Glossudalfs	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
127:				
Cathro	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
141B:				
Leelanau	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
141C:				
Leelanau	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
141D:				
Leelanau	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
146F:				
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
Graycalm	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
147B:				
Lindquist	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
147C:				
Lindquist	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
147D:				
Lindquist	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
147E:				
Lindquist	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
166A:				
Slade	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
197A:				
Gladwin	Poor: wetness.	Probable	Probable	Poor: area reclaim, small stones.
323B:				
East Lake	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.
323C:				
East Lake	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
Rubicon	Good	Probable	Improbable: too sandy.	Poor: too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
337B:				
Mancelona	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
East Lake	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
337C:				
Mancelona	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
East Lake	Good	Probable	Probable	Poor: area reclaim, small stones, too sandy.
338B:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
338C:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
338D:				
Islandlake	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
347F:				
Kalkaska	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
349B:				
Hartwick	Good	Probable	Improbable: thin layer, too sandy.	Poor: small stones, too sandy.
350D:				
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
352B:				
Deford	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Croswell	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
354F:				
Mancelona	Poor: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
Blue Lake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
360:				
Wakeley	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, wetness.
362D:				
Millersburg	Good	Probable	Improbable: too sandy.	Poor: small stones, too sandy.
365F:				
Blue Lake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
368A:				
Au Gres	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Deford	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
369:				
Deford	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
380:				
Access denied.				
387F:				
Mancelona	Poor: slope.	Probable	Probable	Poor: area reclaim, small stones, too sandy.
Rubicon	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
393B:				
Morganlake	Fair: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too acid, too sandy.
393C:				
Morganlake	Fair: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too acid, too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
399D:				
Menominee	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Bamfield	Poor: low strength.	Probable	Improbable: too sandy.	Poor: slope.
Blue Lake	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
400F:				
Menominee	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Bamfield	Poor: slope.	Improbable:	Improbable: too sandy.	Poor: slope.
Blue Lake	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
401F:				
Lindquist	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
402B:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
402C:				
Islandlake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
402D:				
Islandlake	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope, too sandy.
424B:				
Morganlake	Fair: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too acid, too sandy.
Ossineke	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, too clayey.
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
424C:				
Morganlake	Fair: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too acid, too sandy.

Table 17.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
424C:				
Ossineke	Fair: shrink-swell, wetness.	Probable	Improbable: too sandy.	Fair: slope, small stones, too clayey.
Blue Lake	Good	Probable	Improbable: too sandy.	Poor: too sandy.
452D:				
Bamfield	Poor: low strength.	Probable	Improbable: too sandy.	Poor: slope.
452E:				
Bamfield	Poor: slope.	Improbable:	Improbable: too sandy.	Poor: slope.
453B:				
Ossineke	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones, too clayey.
453C:				
Ossineke	Fair: wetness.	Probable	Improbable: too sandy.	Fair: small stones, too clayey.
463F:				
Leelanau	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope, small stones, too sandy.
464B:				
Mossback	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
464C:				
Mossback	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
464D:				
Mossback	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
464E:				
Mossback	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
465:				
Caffey	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.

Table 18.--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
13:							
Tawas--------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave, slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
Lupton-------	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing.	Limitation: wetness.
14:							
Dawson-------	Severe: seepage.	Severe: excess humus, ponding.	Severe: cutbanks cave, slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, rooting depth.	Limitation: ponding.	Limitation: rooting depth, wetness.
Loxley-------	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, too acid.	Limitation: ponding.	Limitation: wetness.
15A:							
Croswell-----	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
Au Gres------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
16B:							
Graycalm-----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
17A:							
Croswell-----	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
17B:							
Croswell-----	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, slope.	Limitation: droughty, slope, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
18A:							
Au Gres------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
19:							
Leafriver----	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
20B:							
Graycalm-----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Grayling-----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
20D:							
Graycalm-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Grayling-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
20F:							
Graycalm-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Grayling-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
23:							
Ausable------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, flooding, ponding.	Limitation: flooding, ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
Bowstring----	Severe: seepage.	Severe: excess humus, wetness.	Severe: cutbanks cave, slow refill.	Limitation: flooding, frost action, subsides.	Limitation: flooding, wetness.	Limitation: wetness.	Limitation: wetness.
24A:							
Kinross------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
Au Gres------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
25B: Kent	Moderate: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: droughty, slope, wetness.	Limitation: wetness.	Limitation: percs slowly.
25C: Kent	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: droughty, slope, wetness.	Limitation: slope, wetness.	Limitation: percs slowly, slope.
28B: East Lake	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
28C: East Lake	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
28E: East Lake	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
32B: Kellogg	Severe: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Limitation: percs slowly, slope.	Limitation: droughty, slope, wetness.	Limitation: percs slowly, soil blowing, wetness.	Limitation: droughty, percs slowly.
33B: Mancelona	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
33C: Mancelona	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
33D: Mancelona	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
33E: Mancelona	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
47D:							
Graycalm-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
47F:							
Graycalm-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
49B:							
Kalkaska-----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
50B:							
Au Gres------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
Kinross------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
Croswell-----	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, slope.	Limitation: droughty, slope, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
51:							
Tawas--------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave, slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
Leafriver----	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing, too sandy.	Limitation: wetness.
52B:							
Blue Lake----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
52D:							
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
52E:							
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
64B:							
Feldhauser	Severe: seepage.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: slope, soil blowing.	Limitation: soil blowing.	Favorable.
65F:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
75B:							
Rubicon	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
75D:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
75E:							
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
78:							
Pits, borrow.							
81B:							
Grayling	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
81D:							
Grayling	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
81E:							
Grayling	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
81F:							
Grayling	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
82B:							
Udorthents	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.	Limitation: variable.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
83B:							
Udipsamments	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
86:							
Histosols----	Slight--------	Severe: excess humus, ponding.	Slight--------	Limitation: frost action, ponding.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing.	Limitation: wetness.
Aquents------	Slight--------	Severe: ponding.	Slight--------	Limitation: frost action, ponding.	Limitation: ponding.	Limitation: ponding.	Limitation: wetness.
90B:							
Chinwhisker--	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty.
95D:							
Menominee----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing.	Limitation: droughty, slope.
95E:							
Menominee----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing.	Limitation: droughty, slope.
113:							
Angelica-----	Slight--------	Severe: piping, ponding.	Severe: slow refill.	Limitation: frost action, ponding.	Limitation: ponding, rooting depth.	Limitation: ponding.	Limitation: rooting depth, wetness.
115D:							
Kalkaska-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
116B:							
Mancelona----	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
126F:							
Udipsamments	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Haplorthods--	Severe: slope.	Slight--------	Severe: no water.	Limitation: deep to water.	Limitation: slope.	Limitation: slope.	Limitation: slope.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
126F:							
Glossudalfs--	Severe: slope.	Slight--------	Severe: no water.	Limitation: deep to water.	Limitation: slope.	Limitation: slope.	Limitation: slope.
127:							
Cathro-------	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Limitation: frost action, ponding, subsides.	Limitation: ponding, soil blowing.	Limitation: ponding, soil blowing.	Limitation: wetness.
141B:							
Leelanau-----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: large stones, too sandy.	Limitation: droughty, large stones.
141C:							
Leelanau-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: large stones, slope, too sandy.	Limitation: droughty, large stones, slope.
141D:							
Leelanau-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: large stones, slope, too sandy.	Limitation: droughty, large stones, slope.
146F:							
Rubicon------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Graycalm-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
147B:							
Lindquist----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
147C:							
Lindquist----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
147D:							
Lindquist----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
147E:							
Lindquist----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
166A:							
Slade	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Limitation: frost action.	Limitation: wetness.	Limitation: wetness.	Limitation: wetness.
197A:							
Gladwin	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
323B:							
East Lake	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
Rubicon	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
323C:							
East Lake	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Rubicon	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
337B:							
Mancelona	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
East Lake	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
337C:							
Mancelona	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
East Lake	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
338B:							
Islandlake	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake.	Limitation: soil blowing, too sandy.	Limitation: droughty.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
338C:							
Islandlake---	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
338D:							
Islandlake---	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
347F:							
Kalkaska-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
349B:							
Hartwick-----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
350D:							
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
352B:							
Deford-------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
Au Gres------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
Croswell-----	Severe: seepage.	Severe: piping, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: too sandy, wetness.	Limitation: droughty.
354F:							
Mancelona----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
360:							
Wakeley------	Severe: seepage.	Severe: ponding.	Severe: no water.	Limitation: percs slowly, ponding.	Limitation: droughty, ponding.	Limitation: percs slowly, ponding, soil blowing.	Limitation: droughty, percs slowly, wetness.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
362D:							
Millersburg--	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing.	Limitation: droughty, slope.
365F:							
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
368A:							
Au Gres------	Severe: seepage.	Severe: piping, seepage, wetness.	Severe: cutbanks cave.	Limitation: cutbanks cave.	Limitation: droughty, wetness.	Limitation: soil blowing, too sandy, wetness.	Limitation: droughty, wetness.
Deford-------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
369:							
Deford-------	Severe: seepage.	Severe: piping, ponding, seepage.	Severe: cutbanks cave.	Limitation: cutbanks cave, ponding.	Limitation: droughty, ponding.	Limitation: ponding, soil blowing, too sandy.	Limitation: droughty, wetness.
380: Access denied.							
387F:							
Mancelona----	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
Rubicon------	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
393B:							
Morganlake---	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope, too acid.	Limitation: droughty, slope, wetness.	Limitation: erodes easily, wetness.	Limitation: droughty, erodes easily.
393C:							
Morganlake---	Severe: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope, too acid.	Limitation: droughty, slope, wetness.	Limitation: erodes easily, slope, wetness.	Limitation: droughty, erodes easily, slope.
399D:							
Menominee----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing.	Limitation: droughty, slope.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
399D:							
Bamfield-----	Severe: slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, rooting depth, slope.
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
400F:							
Menominee----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing.	Limitation: droughty, slope.
Bamfield-----	Severe: slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, rooting depth, slope.
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
401F:							
Lindquist----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
402B:							
Islandlake---	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake.	Limitation: soil blowing, too sandy.	Limitation: droughty.
402C:							
Islandlake---	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty.
402D:							
Islandlake---	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
424B:							
Morganlake---	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope, too acid.	Limitation: droughty, slope, wetness.	Limitation: erodes easily, wetness.	Limitation: droughty, erodes easily.
Ossineke-----	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: slope.	Limitation: slope, soil blowing, wetness.	Limitation: erodes easily, wetness.	Limitation: erodes easily, rooting depth.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
424B:							
Blue Lake----	Severe: seepage.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: soil blowing, too sandy.	Limitation: droughty.
424C:							
Morganlake---	Severe: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope, too acid.	Limitation: droughty, slope, wetness.	Limitation: erodes easily, slope, wetness.	Limitation: droughty, erodes easily, slope.
Ossineke-----	Severe: slope.	Moderate: piping, thin layer, wetness.	Severe: no water.	Limitation: slope.	Limitation: slope, soil blowing, wetness.	Limitation: erodes easily, slope, wetness.	Limitation: erodes easily, rooting depth, slope.
Blue Lake----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: slope, soil blowing, too sandy.	Limitation: droughty, slope.
452D:							
Bamfield-----	Severe: slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, rooting depth, slope.
452E:							
Bamfield-----	Severe: slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, slope, soil blowing.	Limitation: percs slowly, rooting depth, slope.
453B:							
Ossineke-----	Moderate: seepage, slope.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope.	Limitation: slope, soil blowing, wetness.	Limitation: erodes easily, wetness.	Limitation: erodes easily, rooting depth.
453C:							
Ossineke-----	Severe: slope.	Moderate: piping, wetness.	Severe: no water.	Limitation: slope.	Limitation: slope, soil blowing, wetness.	Limitation: erodes easily, slope, wetness.	Limitation: erodes easily, rooting depth, slope.
463F:							
Leelanau-----	Severe: seepage, slope.	Severe: piping, seepage.	Severe: no water.	Limitation: deep to water.	Limitation: droughty, fast intake, slope.	Limitation: large stones, slope, too sandy.	Limitation: droughty, large stones, slope.

Table 18.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
464B:							
Mossback-----	Severe: seepage.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: rooting depth, slope.	Limitation: soil blowing.	Limitation: rooting depth.
464C:							
Mossback-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: rooting depth, slope.	Limitation: slope, soil blowing.	Limitation: rooting depth, slope.
464D:							
Mossback-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: rooting depth, slope.	Limitation: slope, soil blowing.	Limitation: rooting depth, slope.
464E:							
Mossback-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: rooting depth, slope.	Limitation: slope, soil blowing.	Limitation: rooting depth, slope.
465:							
Caffey-------	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave, slow refill.	Limitation: cutbanks cave, ponding.	Limitation: droughty, fast intake, ponding.	Limitation: erodes easily, ponding, soil blowing.	Limitation: droughty, erodes easily, wetness.

Table 19.--Engineering Index Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				*Pct*	*Pct*					*Pct*	
13:												
Tawas-----------	0-9	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	9-24	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	24-80	Sand, loamy sand	SM, SP, SP-SM	A-2-4, A-1-b, A-3, A-4	0	0	90-100	85-100	30-80	0-40	0-14	NP
Lupton----------	0-13	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	13-80	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
14:												
Dawson----------	0-3	Peat-------------	PT	A-8	0	0	---	---	---	---	---	---
	3-32	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	32-80	Sand, loamy sand, gravelly sand, gravelly loamy sand.	SC, GP, SM, SP	A-2, A-1, A-3, A-4	0	0	65-100	55-100	15-90	0-45	0-20	NP-10
Loxley----------	0-3	Peat-------------	PT	A-8	0	0	---	---	---	---	---	---
	3-80	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
15A:												
Croswell--------	0-9	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	5-15	0-14	NP
	9-17	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-75	3-30	0-14	NP
	17-40	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-75	3-30	0-14	NP
	40-80	Sand-------------	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	3-15	0-14	NP
Au Gres---------	0-9	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
	9-42	Sand-------------	SC-SM, SP-SM, SM, SP	A-1-b, A-3, A-2-4	0	0	95-100	85-100	35-75	0-30	0-25	NP-7
	42-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
16B:												
Graycalm--------	0-1	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	35-55	0-15	---	NP
	1-19	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0-1	95-100	85-100	30-75	0-30	---	NP
	19-80	Sand, loamy sand	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	35-55	0-15	---	NP
17A:												
Croswell--------	0-9	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	5-15	0-14	NP
	9-17	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-75	3-30	0-14	NP
	17-40	Sand-------------	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-75	3-30	0-14	NP
	40-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	3-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
17B:												
Croswell--------	0-9	Sand------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	5-15	0-14	NP
	9-17	Sand------------	SM, SP-SM, SP	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-75	3-30	0-14	NP
	17-40	Sand------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-75	3-30	0-14	NP
	40-80	Sand------------	SM, SP, SP-SM	A-2-4, A-1-b, A-3	0	0	90-100	85-100	40-70	3-15	0-14	NP
18A:												
Au Gres---------	0-9	Sand------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	95-100	85-100	35-70	0-15	0-14	NP
	9-42	Sand------------	SC-SM, SM, SP-SM, SP	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-75	0-30	0-25	NP-7
	42-80	Sand------------	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
19:												
Leafriver-------	0-9	Muck------------	PT	A-8	0	0	---	---	---	---	---	---
	9-11	Mucky sand-------	SM	A-2-4, A-4	0	0	97-100	95-100	55-80	15-50	15-20	NP-4
	11-80	Sand------------	SP, SM, SP-SM	A-2, A-2-4, A-1, A-3	0	0	97-100	95-100	45-70	3-35	---	NP
20B:												
Graycalm--------	0-1	Sand------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	35-55	0-15	---	NP
	1-19	Sand------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
	19-80	Sand, loamy sand	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
Grayling--------	0-3	Sand------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	45-70	3-15	0-14	NP
	3-27	Sand------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
	27-60	Sand------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP
	60-80	Sand------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP
20D:												
Graycalm--------	0-1	Sand------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0-1	95-100	85-100	35-55	0-15	---	NP
	1-19	Sand------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0-1	95-100	85-100	30-75	0-30	---	NP
	19-80	Sand, loamy sand	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
Grayling--------	0-3	Sand------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
	3-27	Sand------------	SP, SM, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	45-70	3-15	0-14	NP
	27-60	Sand------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP
	60-80	Sand------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	40-70	0-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
20F:												
Graycalm--------	0-1	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0-1	95-100	85-100	35-55	0-15	---	NP
	1-19	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
	19-80	Sand, loamy sand	SM, SP-SM, SP	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
Grayling--------	0-3	Sand-------------	SP, SM, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	45-70	3-15	0-14	NP
	3-27	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
	27-60	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SP, SM, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP
23:												
Ausable---------	0-10	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	10-46	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	95-100	85-100	50-75	5-30	0-14	NP
	46-52	Muck-------------	---	---	0	0	---	---	---	---	---	---
	52-80	Sand, gravelly sand.	SM, SP-SM, SP	A-1, A-2-4, A-3	0	0	80-100	70-100	35-75	0-30	0-14	NP
Bowstring-------	0-44	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	44-50	Sand-------------	SC-SM, SM, SP-SM	A-2	0	0	100	95-100	50-85	10-35	0-20	NP-5
	50-54	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	54-80	Sand-------------	SC-SM, SP-SM, SM	A-2	---	0	100	95-100	50-85	10-35	0-20	NP-5
24A:												
Kinross---------	0-3	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	3-22	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	100	100	50-80	5-30	0-14	NP
	22-80	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	100	100	50-80	5-30	0-14	NP
Au Gres---------	0-13	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
	13-30	Sand-------------	SC-SM, SP-SM, SM, SP	A-1-b, A-3, A-2-4	0	0	95-100	85-100	35-75	0-30	0-25	NP-7
	30-80	Sand-------------	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
25B:												
Kent------------	0-6	Sandy loam-------	CL, SM, ML, SC	A-2, A-4	0	0-2	98-100	95-100	55-85	25-55	0-30	NP-10
	6-22	Clay-------------	CH	A-7	0	0-2	98-100	95-100	85-100	75-95	50-70	25-40
	22-60	Silty clay-------	CH	A-7	0	0-2	98-100	95-100	85-100	75-95	50-70	25-40
25C:												
Kent------------	0-6	Sandy loam-------	ML, CL, SC, SM	A-2, A-4	0	0-2	98-100	95-100	55-85	25-55	0-30	NP-10
	6-22	Clay-------------	CH	A-7	0	0-2	98-100	95-100	85-100	75-95	50-70	25-40
	22-60	Silty clay-------	CH	A-7	0	0-2	98-100	95-100	85-100	75-95	50-70	25-40

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
28B:												
East Lake-------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-2-4, A-3	0	0-7	95-100	85-100	40-70	0-15	0-14	NP
	4-31	Sand, gravelly sand, loamy sand.	SM, SP, SP-SM	A-1, A-2-4, A-3	0	0-7	85-100	70-100	35-75	0-30	0-14	NP
	31-80	Stratified very gravelly coarse sand to sand.	GW, SP, SW	A-1, A-3, A-2-4	0	0-7	40-75	35-65	25-55	0-10	0-14	NP
28C:												
East Lake-------	0-4	Sand-------------	SM, SP, SP-SM	A-2-4, A-1, A-3	0	0-7	95-100	85-100	40-70	0-15	0-14	NP
	4-31	Sand, loamy sand, gravelly sand.	SM, SP, SP-SM	A-1, A-2-4, A-3	0	0-7	85-100	70-100	35-75	0-30	0-14	NP
	31-80	Stratified very gravelly coarse sand to sand.	GW, SP, SW	A-1, A-3, A-2-4	0	0-7	40-75	35-65	25-55	0-10	0-14	NP
28E:												
East Lake-------	0-4	Sand-------------	SM, SP, SP-SM	A-2-4, A-1, A-3	0	0-7	95-100	85-100	40-70	0-15	0-14	NP
	4-31	Sand, loamy sand, gravelly sand.	SM, SP, SP-SM	A-1, A-2-4, A-3	0	0-7	85-100	70-100	35-75	0-30	0-14	NP
	31-80	Stratified very gravelly coarse sand to sand.	GW, SP, SW	A-1, A-2-4, A-3	0	0-7	40-75	35-65	25-55	0-10	0-14	NP
32B:												
Kellogg---------	0-11	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-70	5-15	0-14	NP
	11-33	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-75	5-30	0-14	NP
	33-36	Loamy sand, silty clay.	CL, SC-SM, CL-ML, SC	A-4, A-6, A-2-4, A-7	0	0	98-100	95-100	45-100	10-95	20-50	4-25
	36-43	Silty clay-------	CH, CL	A-7	0	0	98-100	95-100	90-100	80-95	40-65	20-40
	43-80	Silty clay-------	CH, CL	A-7	0	0	98-100	95-100	90-100	80-95	40-65	20-40
33B:												
Mancelona-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2	0	0-7	95-100	90-100	35-80	10-35	0-14	NP
	3-25	Loamy sand, gravelly sand.	SM, SP-SM	A-1-b, A-3, A-2	0	0-7	80-100	70-95	30-75	5-30	0-14	NP
	25-36	Gravelly loamy sand, very gravelly loamy sand.	SC, SP-SC, SC-SM	A-2, A-4, A-1, A-6	0	0-7	85-100	55-95	35-80	10-50	20-35	4-15
	36-80	Stratified very gravelly sand to sand.	GW, SP, GP, SW	A-1, A-2, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
33C:												
Mancelona-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2	0	0-7	95-100	90-95	35-80	10-35	0-14	NP
	3-25	Loamy sand, gravelly sand.	SM, SP-SM	A-1-b, A-2, A-3	0	0-7	80-100	70-95	30-75	5-30	0-14	NP
	25-36	Gravelly loamy sand, very gravelly loamy sand.	SC, SC-SM, SP-SC	A-1, A-6, A-2, A-4	0	0-7	85-100	55-95	35-80	10-50	20-35	4-15
	36-80	Stratified very gravelly sand to sand.	GP, SW, GW, SP	A-1, A-3, A-2	0	0-7	40-90	30-85	20-60	0-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
33D:												
Mancelona-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2	0	0-7	95-100	90-95	35-80	10-35	0-14	NP
	3-25	Loamy sand, gravelly sand.	SM, SP-SM	A-1-b, A-3, A-2	0	0-7	80-100	70-95	30-75	5-30	0-14	NP
	25-36	Gravelly loamy sand, very gravelly loamy sand.	SC-SM, SC, SP-SC	A-2, A-1, A-4, A-6	0	0-7	85-100	55-95	35-80	10-50	20-35	4-15
	36-80	Stratified very gravelly sand to sand.	GW, SP, GP, SW	A-2, A-1, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
33E:												
Mancelona-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2	0	0-7	95-100	90-95	35-80	10-35	0-14	NP
	3-25	Loamy sand, gravelly sand.	SM, SP-SM	A-2, A-1-b, A-3	0	0-7	80-100	70-95	30-75	5-30	0-14	NP
	25-36	Gravelly loamy sand, very gravelly loamy sand.	SC, SC-SM, SP-SC	A-2, A-4, A-1, A-6	0	0-7	85-100	55-95	35-80	10-50	20-35	4-15
	36-80	Stratified very gravelly sand to sand.	GP, SW, GW, SP	A-1, A-2, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
47D:												
Graycalm--------	0-1	Sand------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	35-55	0-15	---	NP
	1-19	Sand------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
	19-80	Sand, loamy sand	SM, SP-SM, SP	A-1, A-3, A-2	0	0-1	95-100	85-100	30-75	0-30	---	NP
47F:												
Graycalm--------	0-1	Sand------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	35-55	0-15	---	NP
	1-19	Sand------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
	19-80	Sand, loamy sand	SM, SP-SM, SP	A-1, A-3, A-2	0	0-1	95-100	85-100	30-75	0-30	---	NP
49B:												
Kalkaska--------	0-9	Sand------------	SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	45-70	5-15	0-14	NP
	9-28	Sand------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	45-75	5-30	0-14	NP
	28-41	Sand------------	SM	A-1-b, A-3, A-2-4	0	0	95-100	85-100	45-70	5-15	0-14	NP
	41-80	Sand------------	SP, SM, SP-SM	A-2-4, A-1-b, A-3	0	0	95-100	85-100	45-70	0-15	0-14	NP
50B:												
Au Gres---------	0-9	Sand------------	SM, SP-SM, SP	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
	9-42	Sand------------	SM, SP, SC-SM, SP-SM	A-1-b, A-3, A-2-4	0	0	95-100	85-100	35-75	0-30	0-25	NP-7
	42-80	Sand------------	SM, SP, SP-SM	A-2-4, A-1-b, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
50B:												
Kinross---------	0-3	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	3-22	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	100	100	50-80	5-30	0-14	NP
	22-80	Sand-------------	SM, SP-SM	A-2-4, A-3	0	0	100	100	50-80	5-30	0-14	NP
Croswell--------	0-9	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	5-15	0-14	NP
	9-17	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-75	3-30	0-14	NP
	17-40	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-75	3-30	0-14	NP
	40-80	Sand-------------	SM, SP-SM, SP	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	3-15	0-14	NP
51:												
Tawas-----------	0-9	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	9-24	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	24-80	Sand, loamy sand	SP, SM, SP-SM	A-2-4, A-1-b, A-3, A-4	0	0	90-100	85-100	30-80	0-40	0-14	NP
Leafriver-------	0-9	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	9-11	Mucky sand-------	SM	A-2-4, A-4	0	0	97-100	95-100	55-80	15-50	15-20	NP-4
	11-80	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2, A-2-4	0	0	97-100	95-100	45-70	3-35	---	NP
52B:												
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Loamy sand, sand	SM, SP-SM	A-1, A-4, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
52D:												
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Sand, loamy sand	SM, SP-SM	A-2-4, A-1, A-3, A-4	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
52E:												
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-1, A-4	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
64B:												
Feldhauser------	0-10	Fine sandy loam--	SC-SM, SM	A-2-4, A-4	0	0	95-100	90-100	55-85	25-50	0-25	2-7
	10-45	Sandy loam, fine sandy loam, loam.	ML, CL, SC, SM	A-2, A-4	0	0	95-100	90-100	50-95	25-75	0-25	2-9
	45-80	Loamy sand, sand	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	90-100	40-75	5-30	0-20	NP-4
65F:												
Rubicon---------	0-4	Sand-------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	80-100	30-70	0-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
75B:												
Rubicon---------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	80-100	30-70	0-15	0-14	NP
75D:												
Rubicon---------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	80-100	30-70	0-15	0-14	NP
75E:												
Rubicon---------	0-4	Sand-------------	SM, SP, SP-SM	A-2, A-1, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	80-100	30-70	0-15	0-14	NP
78:												
Pits, borrow.												
81B:												
Grayling--------	0-3	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
	3-27	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	90-100	45-70	3-15	0-14	NP
	27-60	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP
81D:												
Grayling--------	0-3	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	90-100	45-70	3-15	0-14	NP
	3-27	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
	27-60	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	40-70	0-15	0-14	NP
81E:												
Grayling--------	0-3	Sand-------------	SP, SM, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	45-70	3-15	0-14	NP
	3-27	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
	27-60	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	40-70	0-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
81F:												
Grayling--------	0-3	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	90-100	45-70	3-15	0-14	NP
	3-27	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	90-100	45-70	3-15	0-14	NP
	27-60	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	90-100	40-70	0-15	0-14	NP
82B:												
Udorthents------	0-10	Sandy loam-------	---	---	---	---	---	---	---	---	---	NP-15
	10-80	Variable---------	---	---	---	---	---	---	---	---	---	---
83B:												
Udipsamments----	0-80	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	85-100	75-100	30-75	0-25	0-14	NP
86:												
Histosols-------	0-51	Muck-------------	PT	A-8	0	0	---	---	---	---	---	NP
	51-80	Variable---------	---	---	---	---	---	---	---	---	---	---
Aquents---------	0-80	Variable---------	---	---	---	---	---	---	---	---	---	---
90B:												
Chinwhisker-----	0-2	Sand-------------	SM, SP, SP-SM	A-2-4, A-1-b, A-3	0	0	95-100	95-100	35-70	0-15	0-14	NP
	2-18	Sand, loamy sand	SM, SP-SM, SP	A-1-b, A-2-4, A-3	0	0	95-100	95-100	35-70	0-25	0-14	NP
	18-22	Sand, loamy sand	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	95-100	35-70	0-25	0-14	NP
	22-41	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	95-100	35-70	0-15	0-14	NP
	41-80	Stratified sand to loamy sand.	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	95-100	95-100	35-75	0-25	0-14	NP
95D:												
Menominee-------	0-8	Loamy sand-------	SM	A-2-4	0	0-5	95-100	80-100	50-75	15-30	---	NP
	8-23	Loamy sand-------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-5	95-100	80-100	30-90	5-30	---	NP
	23-27	Loamy sand, sandy clay loam.	CL, CL-ML	A-4, A-6	0	0-5	85-95	80-95	80-95	60-90	25-40	5-20
	27-80	Sandy clay loam--	CL-ML, SC, CL, SC-SM	A-1, A-2, A-6, A-4	0	0-5	95-100	80-95	45-95	20-80	25-40	5-20
95E:												
Menominee-------	0-8	Loamy sand-------	SM	A-2-4	0	0-5	95-100	80-100	50-75	15-30	---	NP
	8-23	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	80-100	30-90	5-30	---	NP
	23-27	Loamy sand, sandy clay loam.	CL, CL-ML	A-4, A-6	0	0-5	85-95	80-95	80-95	60-90	25-40	5-20
	27-80	Sandy clay loam--	CL-ML, CL, SC, SC-SM	A-1, A-2, A-6, A-4	0	0-5	95-100	80-95	45-95	20-80	25-40	5-20
113:												
Angelica--------	0-8	Loam-------------	ML	A-4, A-6	0	0-5	90-100	85-100	80-100	55-90	25-40	2-13
	8-20	Loam, clay loam--	CL, SC, CL-ML	A-4, A-6	0	0-5	90-100	85-100	70-100	25-90	15-40	5-23
	20-60	Clay loam--------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	80-100	30-90	20-30	4-12

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
115D:												
Kalkaska--------	0-9	Sand-------------	SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	45-70	5-15	0-14	NP
	9-28	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	45-75	5-30	0-14	NP
	28-41	Sand-------------	SM	A-1-b, A-3, A-2-4	0	0	95-100	85-100	45-70	5-15	0-14	NP
	41-80	Sand-------------	SM, SP, SP-SM	A-2-4, A-1-b, A-3	0	0	95-100	85-100	45-70	0-15	0-14	NP
116B:												
Mancelona-------	0-6	Sand-------------	SM, SP-SM	A-1-b, A-2	0	0-7	95-100	90-100	35-80	10-35	0-14	NP
	6-28	Sand, gravelly sand.	SM, SP-SM	A-1-b, A-2, A-3	0	0-7	95-100	90-100	30-75	5-30	0-14	NP
	28-34	Gravelly sandy loam, loamy sand, gravelly loamy sand.	SC, SP-SC, SC-SM	A-2, A-4, A-1, A-6	0	0-7	85-100	60-95	35-80	10-50	20-35	4-15
	34-80	Very gravelly sand, sand.	GP, SW, GW, SP	A-1, A-2, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
126F:												
Udipsamments----	0-60	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	85-100	75-100	30-75	0-25	0-14	NP
Haplorthods-----	0-60	Variable---------	---	---	---	---	---	---	---	---	---	---
Glossudalfs-----	0-60	Variable---------	---	---	---	---	---	---	---	---	---	---
127:												
Cathro----------	0-8	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	8-22	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	22-60	Clay loam, sandy loam.	CL-ML, SC, CL, SC-SM	A-4, A-6	0	0-5	85-100	80-100	60-100	35-90	20-40	4-20
141B:												
Leelanau--------	0-2	Loamy sand-------	SC-SM, SM, SP-SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7
	2-21	Sand-------------	SP-SM, SM, SW-SM	A-1, A-2, A-3	0	0-5	90-100	85-100	35-75	5-30	0-25	NP-7
	21-52	Sandy loam, sand	SC, SC-SM, SM	A-1, A-2, A-4	0	0-5	90-100	85-95	45-70	20-40	20-30	NP-10
	52-80	Loamy sand-------	SM, SW-SM, SP-SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7
141C:												
Leelanau--------	0-2	Loamy sand-------	SC-SM, SM, SP-SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7
	2-21	Sand-------------	SP-SM, SM, SW-SM	A-1, A-2, A-3	0	0-5	90-100	85-100	35-75	5-30	0-25	NP-7
	21-52	Sandy loam, sand	SC, SC-SM, SM	A-1, A-2, A-4	0	0-5	90-100	85-95	45-70	20-40	20-30	NP-10
	52-80	Loamy sand-------	SM, SP-SM, SW-SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
141D:												
Leelanau--------	0-2	Loamy sand-------	SC-SM, SP-SM, SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7
	2-21	Sand-------------	SP-SM, SM, SW-SM	A-1, A-2, A-3	0	0-5	90-100	85-100	35-75	5-30	0-25	NP-7
	21-52	Sandy loam, sand	SC, SC-SM, SM	A-1, A-4, A-2	0	0-5	90-100	85-95	45-70	20-40	20-30	NP-10
	52-80	Loamy sand-------	SM, SW-SM, SP-SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7
146F:												
Rubicon---------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	80-100	30-70	0-15	0-14	NP
Graycalm--------	0-1	Sand-------------	SP, SM, SP-SM	A-1, A-3, A-2	0	0-1	95-100	85-100	35-55	0-15	---	NP
	1-19	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0-1	95-100	85-100	30-75	0-30	---	NP
	19-80	Sand, loamy sand	SM, SP-SM, SP	A-1, A-3, A-2	0	0-1	95-100	85-100	30-75	0-30	---	NP
147B:												
Lindquist-------	0-3	Sand-------------	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	3-28	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	28-80	Loamy sand, sand	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-5	90-100	80-100	35-75	5-25	0-14	NP
147C:												
Lindquist-------	0-3	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	3-28	Sand-------------	SP, SM, SP-SM	A-1-b, A-3, A-2-4	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	28-80	Loamy sand, sand	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-75	5-25	0-14	NP
147D:												
Lindquist-------	0-3	Sand-------------	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	3-28	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	28-80	Loamy sand, sand	SM, SP-SM	A-2-4, A-1-b, A-3	0	0-5	90-100	80-100	35-75	5-25	0-14	NP
147E:												
Lindquist-------	0-3	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	3-28	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	28-80	Loamy sand, sand	SM, SP-SM	A-2-4, A-1-b, A-3	0	0-5	90-100	80-100	35-75	5-25	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
166A:												
Slade-----------	0-10	Loam-------------	CL, ML	A-4	0	0-5	95-100	92-100	55-95	45-85	15-28	NP-9
	10-12	Sandy loam, clay loam.	CL, SM, ML, SC	A-2-4, A-4	0	0-5	95-100	92-100	45-90	20-65	0-26	NP-8
	12-28	Clay loam--------	CL-ML, SC, CL, SC-SM	A-2-4, A-2-6, A-6, A-4	0	0-5	95-100	92-100	45-90	20-65	23-35	6-15
	28-36	Loam-------------	CL, SC	A-2-6, A-4, A-2-4, A-6	0	0-5	95-100	92-100	50-90	30-70	28-35	9-15
	36-80	Loam-------------	CL-ML, CL, SC, SC-SM	A-2-4, A-4	0	0-5	95-100	92-100	45-90	20-60	23-28	6-9
197A:												
Gladwin---------	0-4	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	75-95	45-70	10-30	0-20	NP-4
	4-12	Sand-------------	SC-SM, SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	75-95	35-70	5-30	0-25	NP-5
	12-20	Gravelly loamy sand.	SC, SM, SC-SM	A-1-b, A-2-4	0	0-5	80-100	25-95	10-70	5-35	0-30	NP-9
	20-80	Stratified sand to very gravelly loamy sand.	GW, SP, SP-SM	A-1	0	0-5	55-100	40-85	20-45	0-10	0-14	NP
323B:												
East Lake-------	0-4	Sand-------------	SM, SP, SP-SM	A-2-4, A-1, A-3	0	0-7	95-100	85-100	40-70	0-15	0-14	NP
	4-31	Sand, loamy sand, gravelly sand.	SM, SP-SM, SP	A-1, A-2-4, A-3	0	0-7	85-100	70-100	35-75	0-30	0-14	NP
	31-80	Stratified very gravelly coarse sand to sand.	GW, SW, SP	A-1, A-3, A-2-4	0	0-7	40-75	35-65	25-55	0-10	0-14	NP
Rubicon---------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	30-70	0-15	0-14	NP
323C:												
East Lake-------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-2-4, A-3	0	0-7	95-100	85-100	40-70	0-15	0-14	NP
	4-31	Sand, loamy sand, gravelly sand.	SM, SP-SM, SP	A-1, A-3, A-2-4	0	0-7	85-100	70-100	35-75	0-30	0-14	NP
	31-80	Stratified very gravelly coarse sand to sand.	GW, SP, SW	A-1, A-2-4, A-3	0	0-7	40-75	35-65	25-55	0-10	0-14	NP
Rubicon---------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand-------------	SM, SP-SM, SP	A-1, A-3, A-2	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand-------------	SM, SP-SM, SP	A-1, A-2, A-3	0	0	95-100	80-100	30-70	0-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
337B:												
Mancelona-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2	0	0-7	95-100	90-100	35-80	10-35	0-14	NP
	3-25	Loamy sand, gravelly sand.	SM, SP-SM	A-1-b, A-3, A-2	0	0-7	80-100	70-95	30-75	5-30	0-14	NP
	25-36	Gravelly loamy sand, very gravelly loamy sand.	SC-SM, SC, SP-SC	A-2, A-4, A-1, A-6	0	0-7	85-100	55-95	35-80	10-50	20-35	4-15
	36-80	Stratified very gravelly sand to sand.	GW, SP, GP, SW	A-1, A-2, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
East Lake-------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2-4	0	0-7	95-100	85-100	40-70	0-15	0-14	NP
	4-31	Sand, loamy sand, gravelly sand.	SM, SP-SM, SP	A-2-4, A-1, A-3	0	0-7	85-100	70-100	35-75	0-30	0-14	NP
	31-80	Stratified very gravelly coarse sand to sand.	SW, GW, SP	A-1, A-2-4, A-3	0	0-7	40-75	35-65	25-55	0-10	0-14	NP
337C:												
Mancelona-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2	0	0-7	95-100	90-100	35-80	10-35	0-14	NP
	3-25	Loamy sand, gravelly sand.	SM, SP-SM	A-1-b, A-2, A-3	0	0-7	80-100	70-95	30-75	5-30	0-14	NP
	25-36	Gravelly loamy sand, very gravelly loamy sand.	SC, SC-SM, SP-SC	A-1, A-6, A-2, A-4	0	0-7	85-100	55-95	35-80	10-50	20-35	4-15
	36-80	Stratified very gravelly sand to sand.	GP, SW, GW, SP	A-1, A-2, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
East Lake-------	0-4	Sand-------------	SM, SP, SP-SM	A-1, A-3, A-2-4	0	0-7	95-100	85-100	40-70	0-15	0-14	NP
	4-31	Sand, loamy sand, gravelly sand.	SM, SP, SP-SM	A-1, A-2-4, A-3	0	0-7	85-100	70-100	35-75	0-30	0-14	NP
	31-80	Stratified very gravelly coarse sand to sand.	GW, SP, SW	A-1, A-2-4, A-3	0	0-7	40-75	35-65	25-55	0-10	0-14	NP
338B:												
Islandlake------	0-10	Sand-------------	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	10-13	Sand-------------	SM, SP-SM, SP	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	13-30	Sand-------------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	30-80	Sand, loamy sand	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-70	0-30	0-14	NP
338C:												
Islandlake------	0-10	Sand-------------	SM, SP-SM, SP	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	10-13	Sand-------------	SP, SM, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	13-30	Sand-------------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	30-80	Sand, loamy sand	SP, SM, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-70	0-30	0-14	NP
338D:												
Islandlake------	0-10	Sand-------------	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	10-13	Sand-------------	SM, SP-SM, SP	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	13-30	Sand-------------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	30-80	Sand, loamy sand	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-70	0-30	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
347F:												
Kalkaska--------	0-9	Sand-------------	SM	A-1-b, A-3, A-2-4	0	0	95-100	85-100	45-70	5-15	0-14	NP
	9-28	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	45-75	5-30	0-14	NP
	28-41	Sand-------------	SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	45-70	5-15	0-14	NP
	41-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-3, A-2-4	0	0	95-100	85-100	45-70	0-15	0-14	NP
349B:												
Hartwick--------	0-2	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	75-100	35-70	0-15	0-14	NP
	2-7	Sand-------------	SM, SP-SM, SP	A-1-b, A-2-4, A-3	0	0-5	90-100	75-100	35-70	0-20	0-14	NP
	7-12	Sand-------------	SM, SP	A-1-b, A-2-4, A-3	0	0-5	90-100	75-100	30-70	0-15	0-14	NP
	12-38	Gravelly sand, very gravelly sand.	GP, SM, GM, SP	A-1-b, A-3, A-2-4	0	0-5	50-100	45-100	30-70	0-15	0-14	NP
	38-80	Sand, stratified gravelly coarse sand, stratified gravelly sand.	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0-5	75-100	60-100	30-100	0-15	0-14	NP
350D:												
Blue Lake-------	0-3	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	92-100	40-70	5-15	0-14	NP
	3-6	Sand-------------	SM, SP-SM	A-1-b, A-3, A-2-4	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	6-24	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1, A-4	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
	24-80	Sand, sandy loam	SM, SP-SM	A-2-4, A-1-b, A-3	0	0-5	95-100	92-100	40-75	5-15	0-14	NP
352B:												
Deford----------	0-5	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	5-60	Sand-------------	SP, SM, SP-SM	A-2-4, A-3	0	0	100	95-100	50-80	0-35	15-20	NP-4
Au Gres---------	0-9	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
	9-42	Sand-------------	SC-SM, SP-SM, SM, SP	A-1-b, A-3, A-2-4	0	0	95-100	85-100	35-75	0-30	0-25	NP-7
	42-80	Sand-------------	SM, SP-SM, SP	A-2-4, A-1-b, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
Croswell--------	0-9	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	5-15	0-14	NP
	9-17	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	90-100	85-100	40-75	3-30	0-14	NP
	17-40	Sand-------------	SP, SM, SP-SM	A-2-4, A-1-b, A-3	0	0	90-100	85-100	40-75	3-30	0-14	NP
	40-80	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	90-100	85-100	40-70	3-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
354F:												
Mancelona-------	0-6	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2	0	0-7	95-100	90-100	35-70	0-15	0-14	NP
	6-28	Sand, gravelly sand.	SM, SP-SM	A-2, A-1-b, A-3	0	0-7	95-100	90-100	30-75	5-30	0-14	NP
	28-34	Gravelly sandy loam, loamy sand, gravelly loamy sand.	SC, SC-SM, SP-SC	A-2, A-4, A-1, A-6	0	0-7	85-100	60-95	35-80	10-50	20-35	4-15
	34-80	Very gravelly sand, sand.	GP, SW, GW, SP	A-1, A-2, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
Blue Lake-------	0-3	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	92-100	40-70	5-15	0-14	NP
	3-6	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	6-24	Sand-------------	---	---	0	0-5	95-100	92-100	40-70	5-15	0-14	NP
	24-80	Sand, sandy loam	SM, SP-SM	A-1, A-4, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
360:												
Wakeley---------	0-7	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	7-21	Sand-------------	SC-SM, SP-SM, SM, SP	A-2-4, A-4, A-3	0	0	95-100	95-100	35-95	0-50	0-25	NP-7
	21-80	Silty clay, silty clay loam.	CH, CL	A-7	0	0	95-100	95-100	85-100	75-95	40-65	20-40
362D:												
Millersburg-----	0-2	Loamy sand-------	SC-SM, SM	A-1-b, A-2-4	0	0-5	95-100	80-100	40-75	15-25	0-20	NP-5
	2-10	Sand, loamy sand	SM, SC-SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	80-100	35-70	5-20	0-20	NP-5
	10-26	Sand, loamy sand, sandy loam.	SC-SM, SM, SP-SM	A-1-b, A-4, A-2-4	0	0-5	95-100	80-100	35-65	5-40	0-20	NP-5
	26-43	Sandy loam-------	CL, SM, ML, SC	A-1-b, A-2-4, A-4	0	0-5	95-100	80-100	45-90	20-60	0-30	NP-10
	43-80	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	85-100	80-100	40-65	10-35	0-30	NP-5
365F:												
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Sand, sandy loam	SM, SP-SM	A-1, A-4, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
368A:												
Au Gres---------	0-9	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0	95-100	85-100	35-70	0-15	0-14	NP
	9-42	Sand-------------	SC-SM, SP-SM, SM, SP	A-1-b, A-3, A-2-4	0	0	95-100	85-100	35-75	0-30	0-25	NP-7
	42-80	Sand-------------	SM, SP-SM, SP	A-1-b, A-3, A-2-4	0	0	95-100	85-100	35-70	0-15	0-14	NP
Deford----------	0-5	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	5-60	Sand-------------	SM, SP, SP-SM	A-2-4, A-3	0	0	100	95-100	50-80	0-35	15-20	NP-4
369:												
Deford----------	0-5	Muck-------------	PT	A-8	0	0	---	---	---	---	---	---
	5-60	Sand-------------	SM, SP, SP-SM	A-2-4, A-3	0	0	100	95-100	50-80	0-35	15-20	NP-4
380:												
Access denied.												

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
387F:												
Mancelona-------	0-6	Sand------------	SP, SM, SP-SM	A-1-b, A-2, A-3	0	0-7	95-100	90-100	35-70	0-15	0-14	NP
	6-28	Sand, gravelly sand.	SM, SP-SM	A-1-b, A-3, A-2	0	0-7	95-100	90-100	30-75	5-30	0-14	NP
	28-34	Gravelly sandy loam, loamy sand, gravelly loamy sand.	SC-SM, SC, SP-SC	A-2, A-1, A-4, A-6	0	0-7	85-100	60-95	35-80	10-50	20-35	4-15
	34-80	Very gravelly sand, sand.	GW, SP, GP, SW	A-1, A-2, A-3	0	0-7	40-90	30-85	20-60	0-15	0-14	NP
Rubicon---------	0-4	Sand------------	SM, SP, SP-SM	A-1, A-3, A-2	0	0	95-100	80-100	35-70	0-15	0-14	NP
	4-31	Sand------------	SP, SM, SP-SM	A-1, A-2, A-3	0	0	95-100	80-100	35-70	0-15	0-14	NP
	31-80	Sand------------	SP, SM, SP-SM	A-2, A-1, A-3	0	0	95-100	80-100	30-70	0-15	0-14	NP
393B:												
Morganlake------	0-3	Loamy sand-------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	3-10	Sand------------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	10-39	Sand, loamy sand	SM, SP-SM	A-3	0	0	95-100	90-100	50-75	5-30	0-14	NP
	39-54	Loamy sand, sandy clay loam.	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
	54-80	Sandy clay loam--	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
393C:												
Morganlake------	0-3	Loamy sand-------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	3-10	Sand------------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	10-39	Sand, loamy sand	SM, SP-SM	A-3	0	0	95-100	90-100	50-75	5-30	0-14	NP
	39-54	Loamy sand, sandy clay loam.	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
	54-80	Sandy clay loam--	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
399D:												
Menominee-------	0-8	Loamy sand-------	SM	A-2-4	0	0-5	95-100	80-100	50-75	15-30	---	NP
	8-23	Loamy sand-------	SM	A-2-4	0	0-5	95-100	80-100	50-75	15-30	---	NP
	23-27	Loamy sand, sandy clay loam.	CL, CL-ML	A-4, A-6	0	0-5	85-95	80-95	80-95	60-90	25-40	5-20
	27-80	Sandy clay loam--	CL, SC-SM, CL-ML, SC	A-1, A-6, A-2, A-4	0	0-5	95-100	80-95	45-95	20-80	25-40	5-20
Bamfield--------	0-5	Fine sandy loam--	SC, SC-SM, SM	A-2-4, A-2-6, A-4	0	0-5	95-100	85-100	55-85	30-50	0-30	NP-11
	5-20	Sandy loam-------	SC, SC-SM, SM	A-2-4, A-4, A-2-6	0	0-5	95-100	85-100	50-85	25-50	0-30	NP-11
	20-23	Sandy loam, clay loam.	SC, SC-SM	A-2-4, A-4, A-2-6	0	0-5	95-100	85-100	45-85	20-75	20-35	5-20
	23-51	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	51-64	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-45	15-25
	64-80	Stratified gravelly sand to sand.	SM	A-2-4, A-1-b, A-3	0	0-5	75-100	60-100	30-100	0-15	0-0	NP
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand------------	SM, SP-SM	A-2-4, A-1-b, A-3	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Sand, stratified loamy sand.	SM, SP-SM	A-2-4, A-3, A-1, A-4	0	0-5	95-100	92-100	40-75	5-40	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				*Pct*	*Pct*					*Pct*	
400F:												
Menominee-------	0-8	Loamy sand-------	SM	A-2-4	0	0-5	95-100	80-100	50-75	15-30	---	NP
	8-23	Loamy sand-------	SM	A-2-4	0	0-5	95-100	80-100	50-75	15-30	---	NP
	23-27	Loamy sand, sandy clay loam.	CL, CL-ML	A-4, A-6	0	0-5	85-95	80-95	80-95	60-90	25-40	5-20
	27-80	Sandy clay loam--	CL, SC-SM, CL-ML, SC	A-2, A-4, A-1, A-6	0	0-5	95-100	80-95	45-95	20-80	25-40	5-20
Bamfield--------	0-5	Fine sandy loam--	SC, SC-SM, SM	A-2-4, A-2-6, A-4	0	0-5	95-100	85-100	55-85	30-50	0-30	NP-11
	5-20	Sandy loam-------	SC, SM, SC-SM	A-2-4, A-4, A-2-6	0	0-5	95-100	85-100	50-85	25-50	0-30	NP-11
	20-23	Sandy loam, clay loam.	SC, SC-SM	A-2-4, A-4, A-2-6	0	0-5	95-100	85-100	45-85	20-75	20-35	5-20
	23-51	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	51-64	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-45	15-25
	64-80	Stratified stratified sand.	SM	A-1-b, A-2-4, A-3	0	0-5	75-100	60-100	30-100	0-15	0-0	NP
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand-------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Sand, stratified loamy sand.	SM, SP-SM	A-1, A-4, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
401F:												
Lindquist-------	0-3	Sand-------------	SP, SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	3-28	Sand-------------	SM, SP, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-70	0-15	0-14	NP
	28-80	Sand, loamy sand	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	90-100	80-100	35-75	5-25	0-14	NP
402B:												
Islandlake------	0-2	Loamy sand-------	SM, SP-SM, SP	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	2-7	Loamy sand-------	SP, SM, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	7-12	Loamy sand-------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	12-28	Sand-------------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	28-60	Sand, loamy sand	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SP, SM, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-70	0-30	0-14	NP
402C:												
Islandlake------	0-2	Loamy sand-------	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	2-7	Loamy sand-------	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	7-12	Loamy sand-------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	12-28	Sand-------------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	28-60	Sand, loamy sand	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-70	0-30	0-14	NP
402D:												
Islandlake------	0-2	Loamy sand-------	SM, SP-SM, SP	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	2-7	Loamy sand-------	SM, SP, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-75	0-30	0-14	NP
	7-12	Loamy sand-------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	12-28	Sand-------------	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	28-60	Sand, loamy sand	SP, SP-SM	A-2, A-3	0	0	95-100	85-100	40-70	0-15	0-14	NP
	60-80	Sand-------------	SP, SM, SP-SM	A-2-4, A-3	0	0	95-100	85-100	40-70	0-30	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
424B:												
Morganlake------	0-3	Loamy sand-------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	3-10	Sand------------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	10-39	Sand, loamy sand	SM, SP-SM	A-3	0	0	95-100	90-100	50-75	5-30	0-14	NP
	39-54	Loamy sand, sandy clay loam.	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
	54-80	Sandy clay loam--	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
Ossineke--------	0-8	Fine sandy loam--	SC, SC-SM, SM	A-2-4, A-6, A-4	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	8-13	Sandy loam-------	SC, SM, SC-SM	A-2-4, A-4, A-6	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	13-21	Sandy clay loam, clay loam, loam.	SC-SM	A-4, A-6	0	0-3	95-100	75-98	65-95	35-80	20-45	9-28
	21-38	Sandy clay loam, clay loam, loam.	CL	A-4, A-6	0	0-3	95-100	75-98	65-95	35-80	20-45	9-28
	38-77	Sandy loam, loam			0	0-3	95-100	90-98	70-95	35-80	25-45	NP-20
	77-80	Sand, loamy sand	SC-SM	A-2, A-3	0	0-3	95-100	60-98	30-98	0-15	0-0	NP
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Sand, loamy sand	SM, SP-SM	A-1, A-4, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
424C:												
Morganlake------	0-3	Loamy sand-------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	3-10	Sand------------	SM	A-3	0	0	95-100	90-100	50-70	5-15	0-14	NP
	10-39	Sand, loamy sand	SM, SP-SM	A-3	0	0	95-100	90-100	50-75	5-30	0-14	NP
	39-54	Loamy sand, sandy clay loam.	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
	54-80	Sandy clay loam--	CL	A-6, A-7	0	0	90-100	80-95	65-95	55-75	25-45	10-20
Ossineke--------	0-8	Fine sandy loam--	SC, SC-SM, SM	A-2-4, A-4, A-6	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	8-13	Sandy loam-------	SC, SM, SC-SM	A-2-4, A-4, A-6	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	13-21	Sandy clay loam, clay loam, loam.	SC-SM	A-4, A-6	0	0-3	95-100	90-98	65-95	35-80	20-45	9-28
	21-38	Sandy clay loam, clay loam, loam.	CL	A-4, A-6	0	0-3	95-100	90-98	65-95	35-80	20-45	9-28
	38-77	Sandy loam, loam			0	0-3	95-100	90-98	70-95	35-80	25-45	NP-20
	77-80	Sand, loamy sand	SC-SM	A-2, A-3	0	0-3	95-100	90-98	30-98	0-15	0-0	NP
Blue Lake-------	0-3	Loamy sand-------	SM, SP-SM	A-1-b, A-2-4	0	0-5	95-100	92-100	40-75	10-30	0-14	NP
	3-26	Sand------------	SM, SP-SM	A-1-b, A-2-4, A-3	0	0-5	95-100	92-100	40-75	5-30	0-14	NP
	26-80	Sand, loamy sand	SM, SP-SM	A-2-4, A-3, A-1, A-4	0	0-5	95-100	92-100	40-75	5-40	0-14	NP
452D:												
Bamfield--------	0-5	Fine sandy loam--	SC, SM, SC-SM	A-2-4, A-2-6, A-4	0	0-5	95-100	85-100	55-85	30-50	0-30	NP-11
	5-20	Sandy loam-------	SC-SM, SC, SM	A-2-4, A-2-6, A-4	0	0-5	95-100	85-100	50-85	25-50	0-30	NP-11
	20-23	Sandy loam, clay loam.	SC, SC-SM	A-2-4, A-4, A-2-6	0	0-5	95-100	85-100	45-85	20-75	20-35	5-20
	23-51	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	51-64	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-45	15-25
	64-80	Stratified gravelly sand to sand.	SM	A-1-b, A-2-4, A-3	0	0-5	75-100	60-100	30-100	0-15	0-0	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
452E:												
Bamfield--------	0-5	Fine sandy loam--	SC, SM, SC-SM	A-2-4, A-2-6, A-4	0	0-5	95-100	85-100	55-85	30-50	0-30	NP-11
	5-20	Sandy loam-------	SC-SM, SC, SM	A-2-4, A-4, A-2-6	0	0-5	95-100	85-100	50-85	25-50	0-30	NP-11
	20-23	Sandy loam, clay loam.	SC, SC-SM	A-2-4, A-2-6, A-4	0	0-5	95-100	85-100	45-85	20-75	20-35	5-20
	23-51	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-50	15-25
	51-64	Clay loam--------	---	---	0	0-5	95-100	85-100	70-90	50-80	35-45	15-25
	64-80	Stratified gravelly sand to sand.	SM	A-1-b, A-2-4, A-3	0	0-5	75-100	60-100	30-100	0-15	0-0	NP
453B:												
Ossineke--------	0-8	Fine sandy loam--	SC, SM, SC-SM	A-2-4, A-6, A-4	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	8-13	Sandy loam-------	SC-SM, SC, SM	A-2-4, A-4, A-6	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	13-21	Sandy clay loam, clay loam, loam.	SC-SM	A-4, A-6	0	0-3	95-100	90-98	65-95	35-80	20-45	9-28
	21-38	Sandy clay loam, clay loam, loam.	CL	A-4, A-6	0	0-3	95-100	90-98	65-95	35-80	20-45	9-28
	38-77	Sandy loam, loam			0	0-3	95-100	90-98	70-95	35-80	25-45	NP-20
	77-80	Sand, loamy sand	SM, SC-SM	A-2, A-3	0	0-3	95-100	90-98	30-98	0-15	0-0	NP
453C:												
Ossineke--------	0-8	Fine sandy loam--	SC, SC-SM, SM	A-4, A-2-4, A-6	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	8-13	Sandy loam-------	SC, SC-SM, SM	A-2-4, A-4, A-6	0	0-3	95-100	90-98	55-85	30-50	0-30	NP-11
	13-21	Sandy clay loam, clay loam, loam.	SC-SM	A-4, A-6	0	0-3	95-100	90-98	65-95	35-80	20-45	9-28
	21-38	Sandy clay loam, clay loam, loam.	CL	A-4, A-6	0	0-3	95-100	90-98	65-95	35-80	20-45	9-28
	38-77	Sandy loam, loam			0	0-3	95-100	90-98	70-95	35-80	25-45	NP-20
	77-80	Sand, loamy sand	SM, SC-SM	A-2, A-3	0	0-3	95-100	90-98	30-98	0-15	0-0	NP
463F:												
Leelanau--------	0-2	Loamy sand-------	SC-SM, SM, SP-SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7
	2-21	Sand-------------	SM, SP-SM, SW-SM	A-2, A-1, A-3	0	0-5	90-100	85-100	35-75	5-30	0-25	NP-7
	21-52	Sandy loam, sand	SC, SC-SM, SM	A-1, A-2, A-4	0	0-5	90-100	85-100	45-70	20-40	20-30	NP-10
	52-80	Loamy sand-------	SM, SW-SM, SP-SM	A-1, A-2	0	0-5	90-100	85-100	35-75	10-30	0-25	NP-7
464B:												
Mossback--------	0-3	Sandy loam-------	SC, SC-SM, SM	A-2, A-4	0	0-8	90-100	80-100	45-85	20-50	15-30	3-10
	3-18	Sandy loam, loamy sand.	SC, SM, SC-SM	A-1-b, A-2, A-4	0	0-8	90-100	80-100	45-85	15-45	15-25	NP-10
	18-24	Loam, sandy loam, sandy clay loam.	CL-ML, SC, CL, SC-SM	A-1-b, A-6, A-2, A-4	0	0-8	90-100	80-100	45-95	20-75	20-40	5-20
	24-74	Sandy loam-------	SC, SC-SM, SM	A-1-b, A-2, A-4	0	0-8	90-100	80-100	45-70	20-40	15-30	3-10
	74-80	Gravelly loamy sand, very gravelly sand, sand.	GM, GP, SP, SM	A-3, A-2-4, A-1-b	0	0-8	45-100	35-100	30-70	0-15	0-14	NP

Table 19.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
464C:												
Mossback	0-3	Sandy loam	SC, SC-SM, SM	A-1-b, A-4, A-2	0	0-8	90-100	80-100	45-85	20-50	15-30	3-10
	3-18	Sandy loam, loamy sand.	SC, SM, SC-SM	A-2, A-1-b, A-4	0	0-8	90-100	80-100	45-85	15-45	15-25	NP-10
	18-24	Loam, sandy loam, sandy clay loam.	CL, SC-SM, CL-ML, SC	A-2, A-4, A-1-b, A-6	0	0-8	90-100	80-100	45-95	20-75	20-40	5-20
	24-74	Sandy loam	SC, SC-SM, SM	A-1-b, A-2, A-4	0	0-8	90-100	80-100	45-70	20-40	15-30	3-10
	74-80	Gravelly loamy sand, very gravelly sand, sand.	GP, SM, GM, SP	A-3, A-2-4, A-1-b	0	0-8	45-100	35-100	30-70	0-15	0-14	NP
464D:												
Mossback	0-3	Sandy loam	SC, SC-SM, SM	A-1-b, A-2, A-4	0	0-8	90-100	80-100	45-70	20-40	15-30	3-10
	3-18	Sandy loam, loamy sand.	SC, SM, SC-SM	A-1-b, A-4, A-2	0	0-8	90-100	80-100	45-80	15-45	15-25	NP-10
	18-24	Loam, sandy loam, sandy clay loam.	CL, SC-SM, CL-ML, SC	A-2, A-1-b, A-4, A-6	0	0-8	90-100	80-100	45-95	20-75	20-40	5-20
	24-74	Sandy loam	SC, SC-SM, SM	A-1-b, A-2, A-4	0	0-8	90-100	80-100	45-70	20-40	15-30	3-10
	74-80	Gravelly loamy sand, very gravelly sand, sand.	GP, SM, GM, SP	A-3, A-1-b, A-2-4	0	0-8	45-100	35-100	30-70	0-15	0-14	NP
464E:												
Mossback	0-3	Sandy loam	SC, SC-SM, SM	A-1-b, A-2, A-4	0	0-8	90-100	80-100	45-70	20-40	15-30	3-10
	3-18	Sandy loam, loamy sand.	SC, SM, SC-SM	A-1-b, A-2, A-4	0	0-8	90-100	80-100	45-80	15-45	15-25	NP-10
	18-24	Loam, sandy loam, sandy clay loam.	CL-ML, CL, SC, SC-SM	A-1-b, A-6, A-2, A-4	0	0-8	90-100	80-100	45-95	20-75	20-40	5-20
	24-74	Sandy loam	SC, SC-SM, SM	A-1-b, A-4, A-2	0	0-8	90-100	80-100	45-70	20-40	15-30	3-10
	74-80	Gravelly loamy sand, very gravelly sand, sand.	GM, SP, GP, SM	A-2-4, A-3, A-1-b	0	0-8	45-100	35-100	30-70	0-15	0-14	NP
465:												
Caffey	0-6	Muck	PT	A-8	0	0	---	---	---	---	---	---
	6-18	Loamy sand	SM, SP-SM	A-2-4, A-3, A-4	0	0	95-100	95-100	50-90	5-45	0-14	NP
	18-80	Stratified loamy very fine sand to very fine sandy loam.	CL, CL-ML	A-4, A-6	0	0	95-100	95-100	65-100	50-90	20-40	4-20

Table 20.--Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	*Pct*	*g/cc*	*In/hr*	*In/in*	*Pct*	*Pct*					
13:												
Tawas-----------	0-9	---	0.30-0.55	0.20-6.0	0.35-0.45	---	40-60	---	---	2	2	134
	9-24	---	0.30-0.55	0.20-6.0	0.24-0.45	---	40-60	---	---			
	24-80	0-10	1.40-1.65	6.0-20.0	0.03-0.10	0.0-2.9	0.0-0.5	.15	.15			
Lupton----------	0-13	0-0	0.10-0.35	0.20-6.0	0.35-0.45	---	70-90	---	---	3	2	134
	13-80	0-0	0.10-0.35	0.20-6.0	0.35-0.45	---	70-90	---	---			
14:												
Dawson----------	0-3	0-0	0.15-0.30	6.0-20.0	0.55-0.65	---	65-85	---	---	2	7	38
	3-32	0-0	0.15-0.40	0.20-6.0	0.35-0.45	---	65-85	---	---			
	32-80	0-10	1.55-1.75	6.0-20.0	0.03-0.10	0.0-2.9	0.0-0.5	.10	.15			
Loxley----------	0-3	0-0	0.30-0.40	6.0-20.0	0.35-0.65	---	70-90	---	---	3	7	38
	3-80	0-0	0.10-0.35	0.20-6.0	0.35-0.45	---	70-90	---	---			
15A:												
Croswell--------	0-9	0-10	1.30-1.55	6.0-20.0	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	9-17	0-10	1.40-1.60	6.0-20.0	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	17-40	0-10	1.40-1.60	6.0-20.0	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	40-80	0-10	1.50-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
Au Gres---------	0-9	0-8	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-42	1-15	1.50-1.70	6.0-20.0	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	42-80	0-8	1.50-1.70	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
16B:												
Graycalm--------	0-1	0-10	1.30-1.55	6.0-20.0	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	1-19	0-10	1.25-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	19-80	0-15	1.50-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
17A:												
Croswell--------	0-9	0-10	1.30-1.55	6.0-20.0	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	9-17	0-10	1.40-1.60	6.0-20.0	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	17-40	0-10	1.40-1.60	6.0-20.0	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	40-80	0-10	1.50-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
17B:												
Croswell--------	0-9	0-10	1.30-1.55	6.0-20.0	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	9-17	0-10	1.40-1.60	6.0-20.0	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	17-40	0-10	1.40-1.60	6.0-20.0	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	40-80	0-10	1.50-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
18A:												
Au Gres---------	0-9	0-8	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-42	1-15	1.50-1.70	6.0-20.0	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	42-80	0-8	1.50-1.70	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
19:												
Leafriver-------	0-9	---	0.10-0.25	0.6-6.0	0.35-0.50	---	50-90	---	---	5	2	134
	9-11	3-18	1.40-1.65	2.0-20.0	0.08-0.14	0.0-2.9	5.0-20	.17	.17			
	11-80	0-10	1.50-1.65	6.0-20.0	0.03-0.08	0.0-2.9	0.0-0.5	.17	.17			
20B:												
Graycalm--------	0-1	0-10	1.30-1.55	6.0-20.0	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	1-19	0-15	1.25-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	19-80	0-10	1.50-1.65	6.0-20.0	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
20B:												
Grayling--------	0-3	0-10	1.30-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-6.0	.15	.15	5	1	220
	3-27	0-10	1.30-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	27-60	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
20D:												
Graycalm--------	0-1	0-10	1.30-1.55	6.0-20.0	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	1-19	0-15	1.25-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	19-80	0-10	1.50-1.65	6.0-20.0	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
Grayling--------	0-3	0-10	1.30-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-6.0	.15	.15	5	1	220
	3-27	0-10	1.30-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	27-60	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
20F:												
Graycalm--------	0-1	0-10	1.30-1.55	6.0-20.0	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	1-19	0-15	1.25-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	19-80	0-10	1.50-1.65	6.0-20.0	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
Grayling--------	0-3	0-10	1.30-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-6.0	.15	.15	5	1	220
	3-27	0-10	1.30-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	27-60	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
23:												
Ausable---------	0-10	0-0	0.20-0.30	0.6-6.0	0.35-0.45	---	70-90	---	---	3	2	134
	10-46	0-10	1.40-1.65	6.0-20.0	0.06-0.10	0.0-2.9	5.0-10	.15	.15			
	46-52	0-0	0.20-0.30	0.6-6.0	0.35-0.45	---	70-90	---	---			
	52-80	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	5.0-10	.10	.15			
Bowstring-------	0-44	0-5	0.15-0.30	0.20-6.0	0.35-0.45	---	40-90	---	---	4	8	0
	44-50	1-12	1.40-1.60	0.6-20.0	0.08-0.14	0.0-2.9	0.0-4.0	---	---			
	50-54	0-5	0.15-0.30	0.20-6.0	0.35-0.45	---	40-90	---	---			
	54-80	1-12	1.40-1.60	0.6-20.0	0.08-0.14	0.0-2.9	0.0-0.5	---	---			
24A:												
Kinross---------	0-3	0-0	0.20-0.30	0.6-6.0	0.35-0.45	---	70-90	---	---	5	1	220
	3-22	0-10	1.40-1.70	6.0-20.0	0.04-0.09	0.0-2.9	1.0-4.0	.15	.15			
	22-80	0-10	1.40-1.70	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
Au Gres---------	0-13	0-8	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	13-30	1-15	1.50-1.70	6.0-20.0	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	30-80	0-8	1.50-1.70	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
25B:												
Kent------------	0-6	12-20	1.50-1.70	2.0-6.0	0.14-0.18	0.0-2.9	1.0-3.0	.24	.24	3	3	86
	6-22	45-60	1.40-1.70	0.06-0.20	0.09-0.13	6.0-8.9	0.0-0.5	.28	.28			
	22-60	45-60	1.55-1.65	0.06-0.20	0.08-0.12	6.0-8.9	0.0-0.5	.28	.28			
25C:												
Kent------------	0-6	12-20	1.50-1.70	2.0-6.0	0.14-0.18	0.0-2.9	1.0-3.0	.24	.24	3	3	86
	6-22	45-60	1.40-1.70	0.06-0.20	0.09-0.13	6.0-8.9	0.0-0.5	.28	.28			
	22-60	45-60	1.55-1.65	0.06-0.20	0.08-0.12	6.0-8.9	0.0-0.5	.28	.28			
28B:												
East Lake-------	0-4	0-8	1.30-1.60	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.07-0.10	0.0-2.9	0.6-1.0	.15	.15			
	31-80	0-10	1.50-1.65	>20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
28C:												
East Lake-------	0-4	0-8	1.30-1.60	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.07-0.10	0.0-2.9	0.6-1.0	.15	.15			
	31-80	0-10	1.50-1.65	>20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
28E:												
East Lake-------	0-4	0-8	1.30-1.60	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.07-0.10	0.0-2.9	0.6-1.0	.15	.15			
	31-80	0-10	1.50-1.65	>20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
32B:												
Kellogg---------	0-11	0-10	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	2.0-4.0	.15	.15	5	1	220
	11-33	2-12	1.35-1.60	6.0-20.0	0.06-0.10	0.0-2.9	0.1-1.0	.15	.15			
	33-36	10-40	1.45-1.60	0.20-0.6	0.12-0.15	3.0-5.9	0.0-0.5	.32	.32			
	36-43	35-60	1.50-1.70	0.06-0.20	0.09-0.17	6.0-8.9	0.0-0.5	.32	.32			
	43-80	35-60	1.60-1.70	0.06-0.20	0.08-0.15	6.0-8.9	0.0-0.5	.32	.32			
33B:												
Mancelona-------	0-3	0-10	1.35-1.65	2.0-6.0	0.08-0.12	0.0-2.9	0.5-3.0	.17	.17	4	2	134
	3-25	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	25-36	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	36-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
33C:												
Mancelona-------	0-3	0-10	1.35-1.65	2.0-6.0	0.08-0.12	0.0-2.9	0.5-3.0	.17	.17	4	2	134
	3-25	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	25-36	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	36-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
33D:												
Mancelona-------	0-3	0-10	1.35-1.65	2.0-6.0	0.08-0.12	0.0-2.9	0.5-3.0	.17	.17	4	2	134
	3-25	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	25-36	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	36-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
33E:												
Mancelona-------	0-3	0-10	1.35-1.65	2.0-6.0	0.08-0.12	0.0-2.9	0.5-3.0	.17	.17	4	2	134
	3-25	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	25-36	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	36-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
47D:												
Graycalm--------	0-1	0-10	1.30-1.55	6.0-20.0	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	1-19	0-15	1.25-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	19-80	0-10	1.50-1.65	6.0-20.0	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
47F:												
Graycalm--------	0-1	0-10	1.30-1.55	6.0-20.0	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	1-19	0-15	1.25-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	19-80	0-10	1.50-1.65	6.0-20.0	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
49B:												
Kalkaska--------	0-9	0-10	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	1.0-4.0	.15	.15	5	1	220
	9-28	0-15	1.35-1.45	6.0-20.0	0.06-0.08	0.0-2.9	1.0-3.0	.15	.15			
	28-41	0-10	1.35-1.45	6.0-20.0	0.06-0.08	0.0-2.9	0.5-2.0	.15	.15			
	41-80	0-10	1.35-1.50	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
50B:												
Au Gres---------	0-9	0-8	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-42	1-15	1.50-1.70	6.0-20.0	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	42-80	0-8	1.50-1.70	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
50B:												
Kinross---------	0-3	---	0.10-0.25	0.6-6.0	0.35-0.45	---	50-90	---	---	5	1	220
	3-22	0-10	1.40-1.70	6.0-20.0	0.04-0.09	0.0-2.9	1.0-4.0	.15	.15			
	22-80	0-10	1.40-1.70	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
Croswell--------	0-9	0-10	1.30-1.55	6.0-20.0	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	9-17	0-10	1.40-1.60	6.0-20.0	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	17-40	0-10	1.40-1.60	6.0-20.0	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	40-80	0-10	1.50-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
51:												
Tawas-----------	0-9	---	0.30-0.55	0.20-6.0	0.35-0.45	---	40-60	---	---	2	2	134
	9-24	---	0.30-0.55	0.20-6.0	0.24-0.45	---	40-60	---	---			
	24-80	0-10	1.40-1.65	6.0-20.0	0.03-0.10	0.0-2.9	0.0-0.5	.15	.15			
Leafriver-------	0-9	---	0.10-0.25	0.6-6.0	0.35-0.50	---	50-90	---	---	5	2	134
	9-11	3-18	1.40-1.65	2.0-20.0	0.08-0.14	0.0-2.9	5.0-20	.17	.17			
	11-80	0-10	1.50-1.65	6.0-20.0	0.03-0.08	0.0-2.9	0.0-0.5	.17	.17			
52B:												
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
52D:												
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
52E:												
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
64B:												
Feldhauser------	0-10	2-12	1.30-1.60	2.0-6.0	0.13-0.18	0.0-2.9	0.5-2.0	.24	.24	5	3	86
	10-45	8-18	1.35-1.60	2.0-6.0	0.12-0.19	0.0-2.9	0.0-0.5	.24	.24			
	45-80	0-10	1.55-1.75	6.0-20.0	0.04-0.10	0.0-2.9	0.0-0.5	.17	.17			
65F:												
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
75B:												
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
75D:												
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
75E:												
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
78:												
Pits, borrow.												

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
81B:												
Grayling--------	0-3	0-10	1.30-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-6.0	.15	.15	5	1	220
	3-27	0-10	1.30-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	27-60	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
81D:												
Grayling--------	0-3	0-10	1.30-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-6.0	.15	.15	5	1	220
	3-27	0-10	1.30-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	27-60	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
81E:												
Grayling--------	0-3	0-10	1.30-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-6.0	.15	.15	5	1	220
	3-27	0-10	1.30-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	27-60	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
81F:												
Grayling--------	0-3	0-10	1.30-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-6.0	.15	.15	5	1	220
	3-27	0-10	1.30-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.3-0.5	.15	.15			
	27-60	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-10	1.45-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
82B:												
Udorthents------	0-10	2-18	1.50-1.70	0.6-2.0	0.11-0.18	0.0-2.9	---	.24	---	5	3	86
	10-80	---	---	---	---	---	---	---	---			
83B:												
Udipsamments----	0-80	0-10	1.35-1.65	6.0-20.0	0.05-0.09	0.0-2.9	0.5-1.0	.15	.15	5	1	220
86:												
Histosols-------	0-51	---	---	0.20-6.0	---	---	50-70	---	---	3	2	134
	51-80	---	---	---	---	---	---	---	---			
Aquents---------	0-80	---	---	---	---	---	---	---	---	---	---	---
90B:												
Chinwhisker-----	0-2	0-5	1.30-1.55	6.0-20.0	0.07-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	2-18	0-10	1.30-1.55	6.0-20.0	0.06-0.08	0.0-2.9	0.6-1.0	.10	.15			
	18-22	0-10	1.30-1.55	6.0-20.0	0.06-0.08	0.0-2.9	0.0-0.5	.10	.15			
	22-41	0-5	1.30-1.55	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
	41-80	3-10	1.50-1.65	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
95D:												
Menominee-------	0-8	2-15	1.35-1.65	2.0-6.0	0.10-0.12	0.0-2.9	0.5-3.0	.17	.17	5	2	134
	8-23	5-15	1.45-1.70	6.0-20.0	0.04-0.10	0.0-2.9	0.0-0.5	.15	.17			
	23-27	12-35	1.45-1.70	0.20-0.6	0.14-0.18	3.0-5.9	0.0-0.5	.28	.32			
	27-80	12-35	1.45-1.75	0.20-0.6	0.13-0.18	3.0-5.9	0.0-0.5	.32	.37			
95E:												
Menominee-------	0-8	2-15	1.35-1.65	2.0-6.0	0.10-0.12	0.0-2.9	0.5-3.0	.17	.17	5	2	134
	8-23	5-15	1.45-1.70	6.0-20.0	0.04-0.10	0.0-2.9	0.0-0.5	.15	.17			
	23-27	12-35	1.45-1.70	0.20-0.6	0.14-0.18	3.0-5.9	0.0-0.5	.28	.32			
	27-80	12-35	1.45-1.75	0.20-0.6	0.13-0.18	3.0-5.9	0.0-0.5	.32	.37			
113:												
Angelica--------	0-8	10-20	1.15-1.60	0.6-2.0	0.18-0.22	0.0-2.9	2.0-12	.28	.32	5	5	56
	8-20	18-35	1.50-1.80	0.20-0.6	0.10-0.20	3.0-5.9	0.0-0.5	.28	.32			
	20-60	28-35	1.45-1.95	0.20-0.6	0.10-0.20	0.0-2.9	0.0-0.5	.24	.32			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	*Pct*	*g/cc*	*In/hr*	*In/in*	*Pct*	*Pct*					
115D:												
Kalkaska--------	0-9	0-10	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	1.0-4.0	.15	.15	5	1	220
	9-28	0-15	1.35-1.45	6.0-20.0	0.06-0.08	0.0-2.9	1.0-3.0	.15	.15			
	28-41	0-10	1.35-1.45	6.0-20.0	0.06-0.08	0.0-2.9	0.5-2.0	.15	.15			
	41-80	0-10	1.35-1.50	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
116B:												
Mancelona-------	0-6	0-10	1.35-1.65	2.0-6.0	0.08-0.12	0.0-2.9	0.5-3.0	.17	.17	4	1	220
	6-28	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	28-34	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	34-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
126F:												
Udipsamments----	0-60	0-10	1.35-1.65	6.0-20.0	0.05-0.09	0.0-2.9	0.5-1.0	.15	.15	5	1	220
Haplorthods-----	0-60	---	---	---	---	---	---	---	---	---	---	---
Glossudalfs-----	0-60	---	---	---	---	---	---	---	---	---	---	---
127:												
Cathro----------	0-8	0-0	0.28-0.45	0.20-6.0	0.35-0.45	---	60-85	---	---	2	2	134
	8-22	0-0	0.15-0.30	0.20-6.0	0.35-0.45	---	60-85	.24	.32			
	22-60	10-30	1.50-1.70	0.20-2.0	0.11-0.22	0.0-2.9	0.0-0.5	.32	---			
141B:												
Leelanau--------	0-2	2-15	1.35-1.60	6.0-20.0	0.07-0.10	0.0-2.9	1.0-2.0	.17	.17	5	2	134
	2-21	2-15	1.30-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.6-1.0	.17	.17			
	21-52	10-20	1.30-1.70	2.0-6.0	0.06-0.14	0.0-2.9	0.0-0.5	.24	.24			
	52-80	2-15	1.50-1.70	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.17	.17			
141C:												
Leelanau--------	0-2	2-15	1.35-1.60	6.0-20.0	0.07-0.10	0.0-2.9	1.0-2.0	.17	.17	5	2	134
	2-21	2-15	1.30-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.6-1.0	.17	.17			
	21-52	10-20	1.30-1.70	2.0-6.0	0.06-0.14	0.0-2.9	0.0-0.5	.24	.24			
	52-80	2-15	1.50-1.70	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.17	.17			
141D:												
Leelanau--------	0-2	2-15	1.35-1.60	6.0-20.0	0.07-0.10	0.0-2.9	1.0-2.0	.17	.17	5	2	134
	2-21	2-15	1.30-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.6-1.0	.17	.17			
	21-52	10-20	1.30-1.70	2.0-6.0	0.06-0.14	0.0-2.9	0.0-0.5	.24	.24			
	52-80	2-15	1.50-1.70	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.17	.17			
146F:												
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
Graycalm--------	0-1	0-10	1.30-1.55	6.0-20.0	0.04-0.10	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	1-19	0-15	1.25-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	19-80	0-10	1.50-1.65	6.0-20.0	0.04-0.09	0.0-2.9	0.0-0.5	.10	.15			
147B:												
Lindquist-------	0-3	0-5	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	3-28	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.1-1.0	.10	.15			
	28-80	2-12	1.55-1.65	6.0-20.0	0.05-0.08	0.0-2.9	0.0-0.5	.10	.15			
147C:												
Lindquist-------	0-3	0-5	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	3-28	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.1-1.0	.10	.15			
	28-80	2-12	1.55-1.65	6.0-20.0	0.05-0.08	0.0-2.9	0.0-0.5	.10	.15			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
147D:												
Lindquist-------	0-3	0-5	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	3-28	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.1-1.0	.10	.15			
	28-80	2-12	1.55-1.65	6.0-20.0	0.05-0.08	0.0-2.9	0.0-0.5	.10	.15			
147E:												
Lindquist-------	0-3	0-5	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	3-28	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.1-1.0	.10	.15			
	28-80	2-12	1.55-1.65	6.0-20.0	0.05-0.08	0.0-2.9	0.0-0.5	.10	.15			
166A:												
Slade-----------	0-10	7-18	1.35-1.55	0.6-2.0	0.16-0.24	0.0-2.9	2.0-5.0	.32	.32	5	5	56
	10-12	7-35	1.45-1.65	0.6-2.0	0.09-0.22	0.0-2.9	0.5-1.0	.24	.24			
	12-28	28-35	1.55-1.65	0.6-2.0	0.09-0.18	3.0-5.9	0.1-0.8	.24	.24			
	28-36	18-27	1.55-1.70	0.6-2.0	0.09-0.18	3.0-5.9	0.0-0.5	.32	.32			
	36-80	13-17	1.55-1.80	0.20-0.6	0.09-0.18	0.0-2.9	0.0-0.5	.28	.28			
197A:												
Gladwin---------	0-4	0-12	1.25-1.65	6.0-20.0	0.08-0.12	0.0-2.9	2.0-4.0	.17	.17	4	2	134
	4-12	2-15	1.35-1.65	6.0-20.0	0.05-0.11	0.0-2.9	0.6-1.0	.17	.17			
	12-20	5-18	1.25-1.65	2.0-20.0	0.05-0.14	0.0-2.9	0.0-0.5	.17	.24			
	20-80	0-5	1.35-1.60	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	---			
323B:												
East Lake-------	0-4	0-8	1.30-1.60	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.07-0.10	0.0-2.9	0.6-1.0	.15	.15			
	31-80	0-10	1.50-1.65	>20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
323C:												
East Lake-------	0-4	0-8	1.30-1.60	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.07-0.10	0.0-2.9	0.6-1.0	.15	.15			
	31-80	0-10	1.50-1.65	>20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
337B:												
Mancelona-------	0-3	0-10	1.35-1.65	2.0-6.0	0.08-0.12	0.0-2.9	0.5-3.0	.17	.17	4	2	134
	3-25	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	25-36	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	36-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
East Lake-------	0-4	0-8	1.30-1.60	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.07-0.10	0.0-2.9	0.6-1.0	.15	.15			
	31-80	0-10	1.50-1.65	>20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
337C:												
Mancelona-------	0-3	0-10	1.35-1.65	2.0-6.0	0.08-0.12	0.0-2.9	0.5-3.0	.17	.17	4	2	134
	3-25	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	25-36	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	36-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
East Lake-------	0-4	0-8	1.30-1.60	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.07-0.10	0.0-2.9	0.6-1.0	.15	.15			
	31-80	0-10	1.50-1.65	>20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
338B:												
Islandlake------	0-10	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	10-13	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.17	.17			
	13-30	0-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	30-80	0-15	1.55-1.65	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
338C:												
Islandlake------	0-10	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	10-13	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.17	.17			
	13-30	0-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	30-80	0-15	1.55-1.65	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
338D:												
Islandlake------	0-10	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	10-13	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.17	.17			
	13-30	0-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	30-80	0-15	1.55-1.65	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
347F:												
Kalkaska--------	0-9	0-10	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	1.0-4.0	.15	.15	5	1	220
	9-28	0-15	1.35-1.45	6.0-20.0	0.06-0.08	0.0-2.9	1.0-3.0	.15	.15			
	28-41	0-10	1.35-1.45	6.0-20.0	0.06-0.08	0.0-2.9	0.5-2.0	.15	.15			
	41-80	0-10	1.35-1.50	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.15	.15			
349B:												
Hartwick--------	0-2	0-5	1.35-1.55	6.0-20.0	0.07-0.09	0.0-2.9	1.0-5.0	.15	.15	5	1	220
	2-7	0-10	1.35-1.70	6.0-20.0	0.07-0.09	0.0-2.9	0.1-0.5	.15	.15			
	7-12	0-10	1.35-1.70	6.0-20.0	0.03-0.09	0.0-2.9	0.6-1.0	.17	.17			
	12-38	0-10	1.35-1.70	6.0-20.0	0.03-0.09	0.0-2.9	0.1-1.0	.10	.17			
	38-80	0-5	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
350D:												
Blue Lake-------	0-3	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	3-6	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	6-24	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
	24-80	0-5	1.45-1.70	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
352B:												
Deford----------	0-5	---	0.30-0.50	0.20-6.0	0.35-0.45	---	40-60	---	---	5	2	134
	5-60	0-12	1.40-1.60	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
Au Gres---------	0-9	0-8	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-42	1-15	1.50-1.70	6.0-20.0	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	42-80	0-8	1.50-1.70	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
Croswell--------	0-9	0-10	1.30-1.55	6.0-20.0	0.06-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	9-17	0-10	1.40-1.60	6.0-20.0	0.06-0.10	0.0-2.9	0.6-1.0	.10	.15			
	17-40	0-10	1.40-1.60	6.0-20.0	0.06-0.09	0.0-2.9	0.0-0.5	.10	.15			
	40-80	0-10	1.50-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
354F:												
Mancelona-------	0-6	0-5	1.35-1.65	6.0-20.0	0.06-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	6-28	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	28-34	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	34-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
Blue Lake-------	0-3	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15	5	1	220
	3-6	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	6-24	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.5-2.0	.15	.15			
	24-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	*Pct*	*g/cc*	*In/hr*	*In/in*	*Pct*	*Pct*					
360:												
Wakeley---------	0-7	---	0.30-0.40	6.0-20.0	0.35-0.45	---	40-60	---	---	4	2	134
	7-21	0-15	1.45-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.10	.15			
	21-80	35-60	1.50-1.70	0.06-0.20	0.08-0.12	6.0-8.9	0.0-0.5	.32	.32			
362D:												
Millersburg-----	0-2	3-12	1.35-1.65	2.0-6.0	0.10-0.12	0.0-2.9	3.0-7.0	.17	---	5	2	134
	2-10	2-12	1.30-1.70	2.0-6.0	0.05-0.11	0.0-2.9	0.0-0.5	.17	---			
	10-26	2-18	1.30-1.70	2.0-6.0	0.07-0.13	0.0-2.9	0.0-0.5	.24	---			
	26-43	8-18	1.35-1.70	0.6-2.0	0.10-0.19	0.0-2.9	0.0-0.5	.24	---			
	43-80	3-12	1.55-1.80	0.6-2.0	0.06-0.13	0.0-2.9	0.0-0.5	.17	---			
365F:												
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
368A:												
Au Gres---------	0-9	0-8	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	9-42	1-15	1.50-1.70	6.0-20.0	0.06-0.09	0.0-2.9	0.6-1.0	.10	.15			
	42-80	0-8	1.50-1.70	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.10	.15			
Deford----------	0-5	---	0.30-0.50	0.20-6.0	0.35-0.45	---	40-60	---	---	5	2	134
	5-60	0-12	1.40-1.60	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
369:												
Deford----------	0-5	---	0.30-0.50	0.20-6.0	0.35-0.45	---	40-60	---	---	5	2	134
	5-60	0-12	1.40-1.60	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
380:												
Access denied.												
387F:												
Mancelona-------	0-6	0-5	1.35-1.65	6.0-20.0	0.06-0.09	0.0-2.9	0.5-2.0	.15	.15	4	1	220
	6-28	2-15	1.30-1.65	6.0-20.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.24			
	28-34	10-25	1.30-1.65	2.0-6.0	0.06-0.16	0.0-2.9	0.0-0.5	.17	.24			
	34-80	0-10	1.45-1.65	>20.0	0.02-0.04	0.0-2.9	0.0-0.5	.10	.15			
Rubicon---------	0-4	0-5	1.25-1.45	6.0-20.0	0.05-0.09	0.0-2.9	0.5-2.0	.10	.15	5	1	220
	4-31	0-10	1.30-1.60	6.0-20.0	0.04-0.08	0.0-2.9	0.6-1.0	.10	.15			
	31-80	0-5	1.40-1.65	6.0-20.0	0.04-0.06	0.0-2.9	0.0-0.5	.10	.15			
393B:												
Morganlake------	0-3	1-10	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	3-10	1-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.1-1.0	.15	.15			
	10-39	1-10	1.40-1.65	6.0-20.0	0.09-0.11	0.0-2.9	0.1-0.5	.15	.15			
	39-54	12-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
	54-80	27-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
393C:												
Morganlake------	0-3	1-10	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	3-10	1-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.1-1.0	.15	.15			
	10-39	1-10	1.40-1.65	6.0-20.0	0.09-0.11	0.0-2.9	0.1-0.5	.15	.15			
	39-54	12-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
	54-80	27-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
399D:												
Menominee-------	0-8	2-15	1.35-1.65	2.0-6.0	0.10-0.12	0.0-2.9	0.5-3.0	.17	.17	5	2	134
	8-23	5-15	1.45-1.70	6.0-20.0	0.04-0.10	0.0-2.9	0.0-0.5	.15	.17			
	23-27	12-35	1.45-1.70	0.20-0.6	0.14-0.18	3.0-5.9	0.0-0.5	.28	.32			
	27-80	12-35	1.45-1.75	0.20-0.6	0.13-0.18	3.0-5.9	0.0-0.5	.32	.37			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
399D:												
Bamfield--------	0-5	5-20	1.30-1.60	2.0-6.0	0.14-0.18	0.0-2.9	1.0-3.0	.20	.24	4	3	86
	5-20	5-20	1.35-1.70	2.0-6.0	0.11-0.17	0.0-2.9	0.0-0.5	.20	.24			
	20-23	5-35	1.35-1.80	0.20-2.0	0.11-0.19	0.0-2.9	0.0-0.5	.20	.24			
	23-51	18-35	1.35-1.65	0.20-0.6	0.13-0.19	3.0-5.9	0.0-0.5	.32	.37			
	51-64	18-35	1.70-2.00	0.00-0.06	0.03-0.04	3.0-5.9	0.0-0.5	.32	.37			
	64-80	0-5	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
400F:												
Menominee-------	0-8	2-15	1.35-1.65	2.0-6.0	0.10-0.12	0.0-2.9	0.5-3.0	.17	.17	5	2	134
	8-23	5-15	1.45-1.70	6.0-20.0	0.04-0.10	0.0-2.9	0.0-0.5	.15	.17			
	23-27	12-35	1.45-1.70	0.20-0.6	0.14-0.18	3.0-5.9	0.0-0.5	.28	.32			
	27-80	12-35	1.45-1.75	0.20-0.6	0.13-0.18	3.0-5.9	0.0-0.5	.32	.37			
Bamfield--------	0-5	5-20	1.30-1.60	2.0-6.0	0.14-0.18	0.0-2.9	1.0-3.0	.20	.24	4	3	86
	5-20	5-20	1.35-1.70	2.0-6.0	0.11-0.17	0.0-2.9	0.0-0.5	.20	.24			
	20-23	5-35	1.35-1.80	0.20-2.0	0.11-0.19	0.0-2.9	0.0-0.5	.20	.24			
	23-51	18-35	1.35-1.65	0.20-0.6	0.13-0.19	3.0-5.9	0.0-0.5	.32	.37			
	51-64	18-35	1.70-2.00	0.00-0.06	0.03-0.04	3.0-5.9	0.0-0.5	.32	.37			
	64-80	0-5	1.55-1.65	6.0- 20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
401F:												
Lindquist-------	0-3	0-5	1.30-1.55	6.0-20.0	0.07-0.10	0.0-2.9	2.0-4.0	.10	.15	5	1	220
	3-28	0-5	1.35-1.60	6.0-20.0	0.07-0.09	0.0-2.9	0.1-1.0	.10	.15			
	28-80	2-12	1.55-1.65	6.0-20.0	0.05-0.08	0.0-2.9	0.0-0.5	.10	.15			
402B:												
Islandlake------	0-2	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	2-7	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.17	.17			
	7-12	0-10	1.40-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	12-28	0-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	28-60	0-10	1.55-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-15	1.55-1.65	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
402C:												
Islandlake------	0-2	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	2-7	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.17	.17			
	7-12	0-10	1.40-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	12-28	0-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	28-60	0-10	1.55-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-15	1.55-1.65	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			
402D:												
Islandlake------	0-2	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-2.0	.17	.17	5	1	220
	2-7	0-15	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.17	.17			
	7-12	0-10	1.40-1.65	6.0-20.0	0.07-0.09	0.0-2.9	1.0-3.0	.15	.15			
	12-28	0-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.5-1.0	.15	.15			
	28-60	0-10	1.55-1.65	6.0-20.0	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	60-80	0-15	1.55-1.65	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.15	.15			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility (Ksat)	Available water capacity	Linear extensi-bility	Organic matter	Erosion factors K	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	*Pct*	*g/cc*	*In/hr*	*In/in*	*Pct*	*Pct*					
424B:												
Morganlake------	0-3	1-10	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	3-10	1-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.1-1.0	.15	.15			
	10-39	1-10	1.40-1.65	6.0-20.0	0.09-0.11	0.0-2.9	0.1-0.5	.15	.15			
	39-54	12-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
	54-80	27-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
Ossineke--------	0-8	5-20	1.30-1.60	0.6-2.0	0.14-0.18	0.0-2.9	1.0-3.0	.17	.24	5	3	86
	8-13	5-20	1.50-1.70	0.6-2.0	0.13-0.17	0.0-2.9	0.0-0.5	.17	.24			
	13-21	11-27	1.55-1.70	0.6-2.0	0.14-0.19	0.0-2.9	0.0-0.5	.24	.24			
	21-38	18-35	1.55-1.70	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.37	.37			
	38-77	18-35	1.60-1.80	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.28	.37			
	77-80	0-27	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
424C:												
Morganlake------	0-3	1-10	1.30-1.55	6.0-20.0	0.07-0.12	0.0-2.9	0.5-1.0	.15	.15	5	1	220
	3-10	1-10	1.40-1.65	6.0-20.0	0.06-0.08	0.0-2.9	0.1-1.0	.15	.15			
	10-39	1-10	1.40-1.65	6.0-20.0	0.09-0.11	0.0-2.9	0.1-0.5	.15	.15			
	39-54	12-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
	54-80	27-35	1.45-1.70	0.20-0.6	0.14-0.16	3.0-5.9	0.0-0.5	.37	.43			
Ossineke--------	0-8	5-20	1.30-1.60	0.6-2.0	0.14-0.18	0.0-2.9	1.0-3.0	.17	.24	5	3	86
	8-13	5-20	1.50-1.70	0.6-2.0	0.13-0.17	0.0-2.9	0.0-0.5	.17	.24			
	13-21	11-27	1.55-1.70	0.6-2.0	0.14-0.19	0.0-2.9	0.0-0.5	.24	.24			
	21-38	18-35	1.55-1.70	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.37	.37			
	38-77	18-35	1.60-1.80	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.28	.37			
	77-80	0-27	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
Blue Lake-------	0-3	3-12	1.35-1.60	6.0-20.0	0.10-0.12	0.0-2.9	0.5-2.0	.17	.17	5	2	134
	3-26	5-12	1.30-1.60	6.0-20.0	0.06-0.11	0.0-2.9	0.5-2.0	.17	.17			
	26-80	8-15	1.30-1.60	2.0-6.0	0.06-0.12	0.0-2.9	0.0-0.5	.17	.17			
452D:												
Bamfield--------	0-5	5-20	1.30-1.60	2.0-6.0	0.14-0.18	0.0-2.9	1.0-3.0	.20	.24	4	3	86
	5-20	5-20	1.35-1.70	2.0-6.0	0.11-0.17	0.0-2.9	0.0-0.5	.20	.24			
	20-23	5-35	1.35-1.80	0.20-2.0	0.11-0.19	0.0-2.9	0.0-0.5	.20	.24			
	23-51	18-35	1.35-1.65	0.20-0.6	0.13-0.19	3.0-5.9	0.0-0.5	.32	.37			
	51-64	18-35	1.70-2.00	0.00-0.06	0.03-0.04	3.0-5.9	0.0-0.5	.32	.37			
	64-80	0-5	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
452E:												
Bamfield--------	0-5	5-20	1.30-1.60	2.0-6.0	0.14-0.18	0.0-2.9	1.0-3.0	.20	.24	4	3	86
	5-20	5-20	1.35-1.70	2.0-6.0	0.11-0.17	0.0-2.9	0.0-0.5	.20	.24			
	20-23	5-35	1.35-1.80	0.20-2.0	0.11-0.19	0.0-2.9	0.0-0.5	.20	.24			
	23-51	18-35	1.35-1.65	0.20-0.6	0.13-0.19	3.0-5.9	0.0-0.5	.32	.37			
	51-64	18-35	1.70-2.00	0.00-0.06	0.03-0.04	3.0-5.9	0.0-0.5	.32	.37			
	64-80	0-5	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
453B:												
Ossineke--------	0-8	5-20	1.30-1.60	0.6-2.0	0.14-0.18	0.0-2.9	1.0-3.0	.17	.24	5	3	86
	8-13	5-20	1.50-1.70	0.6-2.0	0.13-0.17	0.0-2.9	0.0-0.5	.17	.24			
	13-21	11-27	1.55-1.70	0.6-2.0	0.14-0.19	0.0-2.9	0.0-0.5	.24	.24			
	21-38	18-35	1.55-1.70	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.37	.37			
	38-77	18-35	1.60-1.80	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.28	.37			
	77-80	0-27	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			

Table 20.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	*Pct*	*g/cc*	*In/hr*	*In/in*	*Pct*	*Pct*					
453C:												
Ossineke--------	0-8	5-20	1.30-1.60	0.6-2.0	0.14-0.18	0.0-2.9	1.0-3.0	.17	.24	5	3	86
	8-13	5-20	1.50-1.70	0.6-2.0	0.13-0.17	0.0-2.9	0.0-0.5	.17	.24			
	13-21	11-27	1.55-1.70	0.6-2.0	0.14-0.19	0.0-2.9	0.0-0.5	.24	.24			
	21-38	18-35	1.55-1.70	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.37	.37			
	38-77	18-35	1.60-1.80	0.6-2.0	0.14-0.19	3.0-5.9	0.0-0.5	.28	.37			
	77-80	0-27	1.55-1.65	6.0-20.0	0.02-0.06	0.0-2.9	0.0-0.5	.10	.15			
463F:												
Leelanau--------	0-2	2-15	1.35-1.60	6.0-20.0	0.07-0.10	0.0-2.9	1.0-2.0	.17	.17	5	2	134
	2-21	2-15	1.30-1.60	6.0-20.0	0.05-0.10	0.0-2.9	0.6-1.0	.17	.17			
	21-52	10-20	1.30-1.70	2.0-6.0	0.06-0.14	0.0-2.9	0.0-0.5	.24	.24			
	52-80	2-15	1.50-1.70	6.0-20.0	0.05-0.10	0.0-2.9	0.0-0.5	.17	.17			
464B:												
Mossback--------	0-3	3-15	1.30-1.65	2.0-6.0	0.13-0.15	0.0-2.9	1.0-3.0	.24	.24	5	3	86
	3-18	3-12	1.40-1.70	2.0-6.0	0.09-0.14	0.0-2.9	0.0-0.5	.24	.24			
	18-24	18-27	1.50-1.75	0.6-2.0	0.11-0.18	0.0-2.9	0.0-0.5	.32	.32			
	24-74	3-15	1.50-1.75	2.0-6.0	0.11-0.13	0.0-2.9	0.0-0.5	.24	.24			
	74-80	0-10	1.45-1.55	6.0-20.0	0.02-0.07	---	0.0-0.5	.15	.15			
464C:												
Mossback--------	0-3	3-15	1.30-1.65	2.0-6.0	0.13-0.15	0.0-2.9	1.0-3.0	.24	.24	5	3	86
	3-18	3-12	1.40-1.70	2.0-6.0	0.09-0.14	0.0-2.9	0.0-0.5	.24	.24			
	18-24	18-27	1.50-1.75	0.6-2.0	0.11-0.18	0.0-2.9	0.0-0.5	.32	.32			
	24-74	3-15	1.50-1.75	2.0-6.0	0.11-0.13	0.0-2.9	0.0-0.5	.24	.24			
	74-80	0-10	1.45-1.55	6.0-20.0	0.02-0.07	---	0.0-0.5	.15	.15			
464D:												
Mossback--------	0-3	3-15	1.30-1.65	2.0-6.0	0.13-0.15	0.0-2.9	1.0-3.0	.24	.24	5	3	86
	3-18	3-12	1.40-1.70	2.0-6.0	0.09-0.14	0.0-2.9	0.0-0.5	.24	.24			
	18-24	18-27	1.50-1.75	0.6-2.0	0.11-0.18	0.0-2.9	0.0-0.5	.32	.32			
	24-74	3-15	1.50-1.75	2.0-6.0	0.11-0.13	0.0-2.9	0.0-0.5	.24	.24			
	74-80	0-10	1.45-1.55	6.0-20.0	0.02-0.07	---	0.0-0.5	.15	.15			
464E:												
Mossback--------	0-3	3-15	1.30-1.65	2.0-6.0	0.13-0.15	0.0-2.9	1.0-3.0	.24	.24	5	3	86
	3-18	3-12	1.40-1.70	2.0-6.0	0.09-0.14	0.0-2.9	0.0-0.5	.24	.24			
	18-24	18-27	1.50-1.75	0.6-2.0	0.11-0.18	0.0-2.9	0.0-0.5	.32	.32			
	24-74	3-15	1.50-1.75	2.0-6.0	0.11-0.13	0.0-2.9	0.0-0.5	.24	.24			
	74-80	0-10	1.45-1.55	6.0-20.0	0.02-0.07	---	0.0-0.5	.15	.15			
465:												
Caffey----------	0-6	---	0.10-0.25	0.6-6.0	0.35-0.50	---	50-90	---	---	5	1	220
	6-18	2-10	1.40-1.55	2.0-20.0	0.06-0.09	0.0-2.9	0.0-0.5	.17	.17			
	18-80	10-27	1.50-1.80	0.20-0.6	0.10-0.20	0.0-2.9	0.0-0.5	.43	.43			

Table 21.--Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
13:					
Tawas-----------	0-9	80-120	---	4.5-7.8	0
	9-24	80-120	---	4.5-7.8	0
	24-80	1.0-3.0	---	5.6-8.4	0
Lupton----------	0-13	140-180	---	5.6-7.8	0
	13-80	140-180	---	5.6-7.8	0
14:					
Dawson----------	0-3	---	80-120	3.6-4.4	0
	3-32	---	150-230	3.6-4.4	0
	32-80	1.0-2.0	---	4.5-6.5	0
Loxley----------	0-3	---	50-100	2.0-4.4	0
	3-80	---	50-120	2.0-4.4	0
15A:					
Croswell--------	0-9	---	1.0-5.0	3.6-6.5	0
	9-17	1.0-4.0	---	4.5-7.3	0
	17-40	1.0-3.0	---	4.5-7.3	0
	40-80	1.0-2.0	---	5.1-8.4	0
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-42	2.0-5.0	---	4.5-7.3	0
	42-80	1.0-2.0	---	5.1-7.3	0
16B:					
Graycalm--------	0-1	4.0-10	---	4.5-6.5	---
	1-19	2.0-4.0	---	4.5-7.3	---
	19-80	0.0-2.0	---	5.6-8.4	---
17A:					
Croswell--------	0-9	---	1.0-5.0	3.6-6.5	0
	9-17	1.0-4.0	---	4.5-7.3	0
	17-40	1.0-3.0	---	4.5-7.3	0
	40-80	1.0-2.0	---	5.1-8.4	0
17B:					
Croswell--------	0-9	---	1.0-5.0	3.6-6.5	0
	9-17	1.0-4.0	---	4.5-7.3	0
	17-40	1.0-3.0	---	4.5-7.3	0
	40-80	1.0-2.0	---	5.1-8.4	0
18A:					
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-42	2.0-5.0	---	4.5-7.3	0
	42-80	1.0-2.0	---	5.1-7.3	0
19:					
Leafriver-------	0-9	100-180	---	5.6-7.3	---
	9-11	10-50	---	5.6-7.3	---
	11-80	1.0-15	---	5.6-7.3	---
20B:					
Graycalm--------	0-1	4.0-10	---	4.5-6.5	---
	1-19	2.0-4.0	---	4.5-7.3	---
	19-80	1.0-5.0	---	4.5-7.3	---

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
20B:					
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-27	---	1.0-4.0	3.5-5.5	0
	27-60	1.0-2.0	---	4.5-6.5	0
	60-80	1.0-2.0	---	5.6-8.4	0-15
20D:					
Graycalm--------	0-1	4.0-10	---	4.5-6.5	---
	1-19	2.0-4.0	---	4.5-7.3	---
	19-80	1.0-5.0	---	4.5-7.3	---
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-27	---	1.0-4.0	3.5-5.5	0
	27-60	1.0-2.0	---	4.5-6.5	0
	60-80	1.0-2.0	---	5.6-8.4	0-15
20F:					
Graycalm--------	0-1	4.0-10	---	4.5-6.5	---
	1-19	2.0-4.0	---	4.5-7.3	---
	19-80	1.0-5.0	---	4.5-7.3	---
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-27	---	1.0-4.0	3.5-5.5	0
	27-60	1.0-2.0	---	4.5-6.5	0
	60-80	1.0-2.0	---	5.6-8.4	0-15
23:					
Ausable---------	0-10	140-180	---	6.1-7.3	0
	10-46	5.0-25	---	6.1-7.8	0
	46-52	140-180	---	6.1-7.3	0
	52-80	5.0-25	---	6.1-7.8	0
Bowstring-------	0-44	---	---	5.6-8.4	---
	44-50	---	---	5.6-8.4	---
	50-54	---	---	5.6-8.4	---
	54-80	---	---	5.6-8.4	---
24A:					
Kinross---------	0-3	---	20-30	3.6-5.0	0
	3-22	---	1.0-10	3.6-6.0	0
	22-80	1.0-2.0	---	4.5-6.5	0
Au Gres---------	0-13	5.0-10	---	3.6-7.3	0
	13-30	2.0-5.0	---	4.5-7.3	0
	30-80	1.0-2.0	---	5.1-7.3	0
25B:					
Kent------------	0-6	4.0-15	---	5.6-7.3	0
	6-22	10-25	---	5.6-7.8	0-10
	22-60	10-25	---	7.4-8.4	20-40
25C:					
Kent------------	0-6	4.0-15	---	5.6-7.3	0
	6-22	10-25	---	5.6-7.8	0-10
	22-60	10-25	---	7.4-8.4	20-40
28B:					
East Lake-------	0-4	1.0-5.0	---	5.6-7.3	0
	4-31	1.0-5.0	---	5.6-7.3	0
	31-80	1.0-2.0	---	7.4-8.4	10-25

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
28C:					
East Lake-------	0-4	1.0-5.0	---	5.6-7.3	0
	4-31	1.0-5.0	---	5.6-7.3	0
	31-80	1.0-2.0	---	7.4-8.4	10-25
28E:					
East Lake-------	0-4	1.0-5.0	---	5.6-7.3	0
	4-31	1.0-5.0	---	5.6-7.3	0
	31-80	1.0-2.0	---	7.4-8.4	10-25
32B:					
Kellogg---------	0-11	---	0.4-3.0	4.5-6.0	0
	11-33	---	0.4-2.5	4.5-6.0	0
	33-36	4.0-15	---	6.1-7.8	0
	36-43	10-25	---	6.1-7.8	0-5
	43-80	10-25	---	7.4-8.4	5-25
33B:					
Mancelona-------	0-3	2.0-10	---	5.1-7.3	0
	3-25	1.0-10	---	5.6-7.8	0
	25-36	4.0-15	---	6.1-7.8	---
	36-80	1.0-4.0	---	7.4-8.4	10-25
33C:					
Mancelona-------	0-3	2.0-10	---	5.1-7.3	0
	3-25	1.0-10	---	5.6-7.8	0
	25-36	4.0-15	---	6.1-7.8	---
	36-80	1.0-4.0	---	7.4-8.4	10-25
33D:					
Mancelona-------	0-3	2.0-10	---	5.1-7.3	0
	3-25	1.0-10	---	5.6-7.8	0
	25-36	4.0-15	---	6.1-7.8	---
	36-80	1.0-4.0	---	7.4-8.4	10-25
33E:					
Mancelona-------	0-3	2.0-10	---	5.1-7.3	0
	3-25	1.0-10	---	5.6-7.8	0
	25-36	4.0-15	---	6.1-7.8	---
	36-80	1.0-4.0	---	7.4-8.4	10-25
47D:					
Graycalm--------	0-1	4.0-10	---	4.5-6.5	---
	1-19	2.0-4.0	---	4.5-7.3	---
	19-80	1.0-5.0	---	4.5-7.3	---
47F:					
Graycalm--------	0-1	4.0-10	---	4.5-6.5	---
	1-19	2.0-4.0	---	4.5-7.3	---
	19-80	1.0-5.0	---	4.5-7.3	---
49B:					
Kalkaska--------	0-9	---	1.0-15	3.6-6.0	0
	9-28	---	4.0-15	3.6-6.0	0
	28-41	---	2.0-5.0	4.5-6.0	0
	41-80	1.0-2.0	---	4.5-6.5	0
50B:					
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-42	2.0-5.0	---	4.5-7.3	0
	42-80	1.0-2.0	---	5.1-7.3	0

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
50B:					
Kinross---------	0-3	---	20-30	3.6-5.0	0
	3-22	---	1.0-10	3.6-6.0	0
	22-80	1.0-2.0	---	4.5-6.5	0
Croswell--------	0-9	---	1.0-5.0	3.6-6.5	0
	9-17	1.0-4.0	---	4.5-7.3	0
	17-40	1.0-3.0	---	4.5-7.3	0
	40-80	1.0-2.0	---	5.1-8.4	0
51:					
Tawas-----------	0-9	80-120	---	4.5-7.8	0
	9-24	80-120	---	4.5-7.8	0
	24-80	1.0-3.0	---	5.6-8.4	0
Leafriver-------	0-9	100-180	---	5.6-7.3	---
	9-11	10-50	---	5.6-7.3	---
	11-80	1.0-15	---	5.6-7.3	---
52B:					
Blue Lake-------	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
52D:					
Blue Lake-------	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
52E:					
Blue Lake-------	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
64B:					
Feldhauser------	0-10	2.0-10	---	5.1-6.5	0
	10-45	2.0-10	---	4.5-6.5	0
	45-80	1.0-4.0	---	4.5-7.3	0
65F:					
Rubicon---------	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
75B:					
Rubicon---------	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
75D:					
Rubicon---------	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
75E:					
Rubicon---------	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
78:					
Pits, borrow.					

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
81B:					
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-27	---	1.0-4.0	3.5-5.5	0
	27-60	1.0-2.0	---	4.5-6.5	0
	60-80	1.0-2.0	---	5.6-8.4	0-15
81D:					
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-27	---	1.0-4.0	3.5-5.5	0
	27-60	1.0-2.0	---	4.5-6.5	0
	60-80	1.0-2.0	---	5.6-8.4	0-15
81E:					
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-27	---	1.0-4.0	3.5-5.5	0
	27-60	1.0-2.0	---	4.5-6.5	0
	60-80	1.0-2.0	---	5.6-8.4	0-15
81F:					
Grayling--------	0-3	---	2.0-14	3.5-5.5	0
	3-27	---	1.0-4.0	3.5-5.5	0
	27-60	1.0-2.0	---	4.5-6.5	0
	60-80	1.0-2.0	---	5.6-8.4	0-15
82B:					
Udorthents------	0-10	---	---	---	---
	10-80	---	---	---	---
83B:					
Udipsamments----	0-80	---	---	5.1-6.5	---
86:					
Histosols-------	0-51	---	---	---	---
	51-80	---	---	---	---
Aquents---------	0-80	---	---	---	---
90B:					
Chinwhisker-----	0-2	4.0-10	---	4.5-6.5	0
	2-18	---	2.0-3.0	4.5-6.0	0
	18-22	1.0-2.0	---	4.5-6.5	0
	22-41	1.0-2.0	---	4.5-7.3	0
	41-80	2.0-4.0	---	5.6-8.4	0
95D:					
Menominee-------	0-8	2.0-10	---	4.5-6.5	---
	8-23	1.0-6.0	---	4.5-7.8	---
	23-27	5.0-20	---	5.1-7.8	1-10
	27-80	5.0-25	---	6.1-8.4	20-30
95E:					
Menominee-------	0-8	2.0-10	---	4.5-6.5	---
	8-23	1.0-6.0	---	4.5-7.8	---
	23-27	5.0-20	---	5.1-7.8	1-10
	27-80	5.0-25	---	6.1-8.4	20-30
113:					
Angelica--------	0-8	5.0-30	---	6.1-7.3	0
	8-20	3.0-15	---	6.1-7.8	0-15
	20-60	2.0-10	---	7.9-8.4	15-30

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
115D:					
Kalkaska--------	0-9	---	1.0-15	3.6-6.0	0
	9-28	---	4.0-15	3.6-6.0	0
	28-41	---	2.0-5.0	4.5-6.0	0
	41-80	1.0-2.0	---	4.5-6.5	0
116B:					
Mancelona-------	0-6	2.0-10	---	5.1-7.3	0
	6-28	1.0-10	---	5.6-7.8	0
	28-34	4.0-15	---	6.1-7.8	---
	34-80	1.0-4.0	---	7.4-8.4	10-25
126F:					
Udipsamments----	0-60	---	---	5.1-6.5	---
Haplorthods-----	0-60	---	---	---	---
Glossudalfs-----	0-60	---	---	---	---
127:					
Cathro----------	0-8	150-230	---	4.5-7.8	0
	8-22	150-230	---	4.5-7.8	0
	22-60	2.0-20	---	5.6-8.4	5-25
141B:					
Leelanau--------	0-2	3.0-10	---	5.6-7.3	---
	2-21	1.0-4.0	---	5.6-7.3	---
	21-52	2.0-10	---	6.1-7.3	---
	52-80	1.0-5.0	---	7.4-8.4	---
141C:					
Leelanau--------	0-2	3.0-10	---	5.6-7.3	---
	2-21	1.0-4.0	---	5.6-7.3	---
	21-52	2.0-10	---	6.1-7.3	---
	52-80	1.0-5.0	---	7.4-8.4	---
141D:					
Leelanau--------	0-2	3.0-10	---	5.6-7.3	---
	2-21	1.0-4.0	---	5.6-7.3	---
	21-52	2.0-10	---	6.1-7.3	---
	52-80	1.0-5.0	---	7.4-8.4	---
146F:					
Rubicon---------	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
Graycalm--------	0-1	4.0-10	---	4.5-6.5	---
	1-19	2.0-4.0	---	4.5-7.3	---
	19-80	1.0-5.0	---	4.5-7.3	---
147B:					
Lindquist-------	0-3	---	5.0-10	4.5-5.5	0
	3-28	---	1.0-2.0	4.5-5.5	0
	28-80	1.0-4.0	---	5.6-7.3	0
147C:					
Lindquist-------	0-3	---	5.0-10	4.5-5.5	0
	3-28	---	1.0-2.0	4.5-5.5	0
	28-80	1.0-4.0	---	5.6-7.3	0

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
147D:					
Lindquist-------	0-3	---	5.0-10	4.5-5.5	0
	3-28	---	1.0-2.0	4.5-5.5	0
	28-80	1.0-4.0	---	5.6-7.3	0
147E:					
Lindquist-------	0-3	---	5.0-10	4.5-5.5	0
	3-28	---	1.0-2.0	4.5-5.5	0
	28-80	1.0-4.0	---	5.6-7.3	0
166A:					
Slade-----------	0-10	5.0-25	---	4.5-7.8	0
	10-12	1.0-15	---	4.5-7.8	0
	12-28	2.0-20	---	4.5-7.8	0
	28-36	4.0-25	---	4.5-7.8	0
	36-80	2.0-15	---	7.4-8.4	1-10
197A:					
Gladwin---------	0-4	4.0-15	---	5.1-7.8	0
	4-12	1.0-5.0	---	5.1-7.8	0
	12-20	2.0-10	---	5.6-7.8	0-2
	20-80	1.0-2.0	---	7.9-8.4	1-20
323B:					
East Lake-------	0-4	1.0-5.0	---	5.6-7.3	0
	4-31	1.0-5.0	---	5.6-7.3	0
	31-80	1.0-2.0	---	7.4-8.4	10-25
Rubicon---------	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
323C:					
East Lake-------	0-4	1.0-5.0	---	5.6-7.3	0
	4-31	1.0-5.0	---	5.6-7.3	0
	31-80	1.0-2.0	---	7.4-8.4	10-25
Rubicon---------	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
337B:					
Mancelona-------	0-3	2.0-10	---	5.1-7.3	0
	3-25	1.0-10	---	5.6-7.8	0
	25-36	4.0-15	---	6.1-7.8	---
	36-80	1.0-4.0	---	7.4-8.4	10-25
East Lake-------	0-4	1.0-5.0	---	5.6-7.3	0
	4-31	1.0-5.0	---	5.6-7.3	0
	31-80	1.0-2.0	---	7.4-8.4	10-25
337C:					
Mancelona-------	0-3	2.0-10	---	5.1-7.3	0
	3-25	1.0-10	---	5.6-7.8	0
	25-36	4.0-15	---	6.1-7.8	---
	36-80	1.0-4.0	---	7.4-8.4	10-25
East Lake-------	0-4	1.0-5.0	---	5.6-7.3	0
	4-31	1.0-5.0	---	5.6-7.3	0
	31-80	1.0-2.0	---	7.4-8.4	10-25

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
338B:					
Islandlake------	0-10	---	1.0-11	4.5-6.0	0
	10-13	---	1.0-9.0	4.5-6.0	0
	13-30	---	1.0-6.0	4.5-6.0	0
	30-80	0.0-7.0	---	6.1-7.8	0
338C:					
Islandlake------	0-10	---	1.0-11	4.5-6.0	0
	10-13	---	1.0-9.0	4.5-6.0	0
	13-30	---	1.0-6.0	4.5-6.0	0
	30-80	0.0-7.0	---	6.1-7.8	0
338D:					
Islandlake------	0-10	---	1.0-11	4.5-6.0	0
	10-13	---	1.0-9.0	4.5-6.0	0
	13-30	---	1.0-6.0	4.5-6.0	0
	30-80	0.0-7.0	---	6.1-7.8	0
347F:					
Kalkaska--------	0-9	---	1.0-15	3.6-6.0	0
	9-28	---	4.0-15	3.6-6.0	0
	28-41	---	2.0-5.0	4.5-6.0	0
	41-80	1.0-2.0	---	4.5-6.5	0
349B:					
Hartwick--------	0-2	---	0.4-3.0	4.5-6.0	0
	2-7	---	0.4-2.5	4.5-6.0	0
	7-12	---	0.2-1.1	4.5-6.0	0
	12-38	---	0.2-1.1	4.5-6.0	0
	38-80	1.0-2.0	---	7.4-8.4	5-25
350D:					
Blue Lake-------	0-3	1.0-5.0	---	5.1-6.5	0
	3-6	2.0-6.0	---	5.1-6.5	0
	6-24	1.0-8.0	---	5.1-6.5	0
	24-80	1.0-2.0	---	5.6-7.8	0
352B:					
Deford----------	0-5	80-120	---	5.6-7.8	---
	5-60	1.0-5.0	---	5.6-8.4	---
Au Gres---------	0-9	5.0-10	---	3.6-7.3	0
	9-42	2.0-5.0	---	4.5-7.3	0
	42-80	1.0-2.0	---	5.1-7.3	0
Croswell--------	0-9	---	1.0-5.0	3.6-6.5	0
	9-17	1.0-4.0	---	4.5-7.3	0
	17-40	1.0-3.0	---	4.5-7.3	0
	40-80	1.0-2.0	---	5.1-8.4	0
354F:					
Mancelona-------	0-6	2.0-10	---	5.1-7.3	0
	6-28	1.0-10	---	5.6-7.8	0
	28-34	4.0-15	---	6.1-7.8	---
	34-80	1.0-4.0	---	7.4-8.4	10-25
Blue Lake-------	0-3	1.0-5.0	---	5.1-6.5	0
	3-6	2.0-6.0	---	5.1-6.5	0
	6-24	1.0-5.0	---	5.1-6.5	0
	24-80	1.0-8.0	---	5.1-6.5	0

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	meq/100g	meq/100g	pH	Pct
360:					
Wakeley	0-7	80-120	---	5.6-7.8	0
	7-21	1.0-10	---	5.6-7.8	0
	21-80	5.0-25	---	7.4-8.4	10-30
362D:					
Millersburg	0-2	---	5.0-20	3.6-6.5	0
	2-10	1.0-5.0	---	4.5-7.3	0
	10-26	1.0-5.0	---	4.5-7.3	0
	26-43	2.0-5.0	---	6.1-7.8	0-10
	43-80	2.0-5.0	---	7.4-8.4	10-30
365F:					
Blue Lake	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
368A:					
Au Gres	0-9	5.0-10	---	3.6-7.3	0
	9-42	2.0-5.0	---	4.5-7.3	0
	42-80	1.0-2.0	---	5.1-7.3	0
Deford	0-5	80-120	---	5.6-7.8	---
	5-60	1.0-5.0	---	5.6-8.4	---
369:					
Deford	0-5	80-120	---	5.6-7.8	---
	5-60	1.0-5.0	---	5.6-8.4	---
380:					
Access denied.					
387F:					
Mancelona	0-6	2.0-10	---	5.1-7.3	0
	6-28	1.0-10	---	5.6-7.8	0
	28-34	4.0-15	---	6.1-7.8	---
	34-80	1.0-4.0	---	7.4-8.4	10-25
Rubicon	0-4	---	1.0-6.0	4.5-6.0	0
	4-31	---	1.0-4.0	4.5-6.0	0
	31-80	1.0-2.0	---	4.5-6.5	0
393B:					
Morganlake	0-3	---	2.0-7.0	3.5-7.3	0
	3-10	---	1.0-7.0	3.5-6.0	0
	10-39	---	1.0-4.0	3.5-6.0	0
	39-54	5.0-14	---	5.6-7.8	0
	54-80	5.0-14	---	7.4-8.4	10-30
393C:					
Morganlake	0-3	---	2.0-7.0	3.5-7.3	0
	3-10	---	1.0-7.0	3.5-6.0	0
	10-39	---	1.0-4.0	3.5-6.0	0
	39-54	5.0-14	---	5.6-7.8	0
	54-80	5.0-14	---	7.4-8.4	10-30
399D:					
Menominee	0-8	2.0-10	---	4.5-6.5	---
	8-23	1.0-6.0	---	4.5-7.8	---
	23-27	5.0-20	---	5.1-7.8	1-10
	27-80	5.0-25	---	6.1-8.4	20-30

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	meq/100g	meq/100g	pH	Pct
399D:					
Bamfield--------	0-5	---	5.0-15	4.5-5.0	0
	5-20	---	2.0-10	5.1-5.5	0
	20-23	---	2.0-10	5.1-5.5	0
	23-51	0.0-10	---	5.6-8.4	0-10
	51-64	5.0-30	---	7.9-8.4	10-30
	64-80	5.0-25	---	7.9-8.4	5-25
Blue Lake-------	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
400F:					
Menominee-------	0-8	2.0-10	---	4.5-6.5	---
	8-23	1.0-6.0	---	4.5-7.8	---
	23-27	5.0-20	---	5.1-7.8	1-10
	27-80	5.0-25	---	6.1-8.4	20-30
Bamfield--------	0-5	---	5.0-15	4.5-5.0	0
	5-20	---	2.0-10	5.1-5.5	0
	20-23	---	2.0-10	5.1-5.5	0
	23-51	0.0-10	---	5.6-8.4	0-10
	51-64	5.0-30	---	7.9-8.4	10-30
	64-80	5.0-25	---	7.9-8.4	5-25
Blue Lake-------	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
401F:					
Lindquist-------	0-3	---	5.0-10	4.5-5.5	0
	3-28	---	1.0-2.0	4.5-5.5	0
	28-80	1.0-4.0	---	5.6-7.3	0
402B:					
Islandlake------	0-2	---	1.0-11	4.5-6.0	0
	2-7	---	1.0-9.0	4.5-6.0	0
	7-12	---	2.0-10	4.5-6.0	0
	12-28	---	1.0-6.0	4.5-6.0	0
	28-60	0.0-5.0	---	5.1-7.3	0
	60-80	0.0-7.0	---	6.1-7.8	0
402C:					
Islandlake------	0-2	---	1.0-11	4.5-6.0	0
	2-7	---	1.0-9.0	4.5-6.0	0
	7-12	---	2.0-10	4.5-6.0	0
	12-28	---	1.0-6.0	4.5-6.0	0
	28-60	0.0-5.0	---	5.1-7.3	0
	60-80	0.0-7.0	---	6.1-7.8	0
402D:					
Islandlake------	0-2	---	1.0-11	4.5-6.0	0
	2-7	---	1.0-9.0	4.5-6.0	0
	7-12	---	2.0-10	4.5-6.0	0
	12-28	---	1.0-6.0	4.5-6.0	0
	28-60	0.0-5.0	---	5.1-7.3	0
	60-80	0.0-7.0	---	6.1-7.8	0

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
424B:					
Morganlake------	0-3	---	2.0-7.0	3.5-7.3	0
	3-10	---	1.0-7.0	3.5-6.0	0
	10-39	---	1.0-4.0	3.5-6.0	0
	39-54	5.0-14	---	5.6-7.8	0
	54-80	5.0-14	---	7.4-8.4	10-30
Ossineke--------	0-8	---	3.0-14	4.5-6.0	0
	8-13	1.0-8.0	---	5.1-6.0	0
	13-21	2.0-11	---	5.1-6.0	0
	21-38	3.0-14	---	5.6-6.5	0
	38-77	3.0-14	---	6.6-8.4	10-30
	77-80	1.0-2.0	---	7.4-8.4	5-25
Blue Lake-------	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
424C:					
Morganlake------	0-3	---	2.0-7.0	3.5-7.3	0
	3-10	---	1.0-7.0	3.5-6.0	0
	10-39	---	1.0-4.0	3.5-6.0	0
	39-54	5.0-14	---	5.6-7.8	0
	54-80	5.0-14	---	7.4-8.4	10-30
Ossineke--------	0-8	---	3.0-14	4.5-6.0	0
	8-13	1.0-8.0	---	5.1-6.0	0
	13-21	2.0-11	---	5.1-6.0	0
	21-38	3.0-14	---	5.6-6.5	0
	38-77	3.0-14	---	6.6-8.4	10-30
	77-80	1.0-2.0	---	7.4-8.4	5-25
Blue Lake-------	0-3	2.0-7.0	---	5.1-6.5	0
	3-26	2.0-6.0	---	5.1-6.5	0
	26-80	1.0-8.0	---	5.1-6.5	0
452D:					
Bamfield--------	0-5	---	5.0-15	4.5-5.0	0
	5-20	---	2.0-10	5.1-5.5	0
	20-23	---	2.0-10	5.1-5.5	0
	23-51	0.0-10	---	5.6-8.4	0-10
	51-64	5.0-30	---	7.9-8.4	10-30
	64-80	5.0-25	---	7.9-8.4	5-25
452E:					
Bamfield--------	0-5	---	5.0-15	4.5-5.0	0
	5-20	---	2.0-10	5.1-5.5	0
	20-23	---	2.0-10	5.1-5.5	0
	23-51	0.0-10	---	5.6-8.4	0-10
	51-64	5.0-30	---	7.9-8.4	10-30
	64-80	5.0-25	---	7.9-8.4	5-25
453B:					
Ossineke--------	0-8	---	3.0-14	4.5-6.0	0
	8-13	1.0-8.0	---	5.1-6.0	0
	13-21	2.0-11	---	5.1-6.0	0
	21-38	3.0-14	---	5.6-6.5	0
	38-77	3.0-14	---	6.6-8.4	10-30
	77-80	1.0-2.0	---	7.4-8.4	5-25

Table 21.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate equivalent
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*
453C:					
Ossineke--------	0-8	---	3.0-14	4.5-6.0	0
	8-13	1.0-8.0	---	5.1-6.0	0
	13-21	2.0-11	---	5.1-6.0	0
	21-38	3.0-14	---	5.6-6.5	0
	38-77	3.0-14	---	6.6-8.4	10-30
	77-80	1.0-2.0	---	7.4-8.4	5-25
463F:					
Leelanau--------	0-2	3.0-10	---	5.6-7.3	---
	2-21	1.0-4.0	---	5.6-7.3	---
	21-52	2.0-10	---	6.1-7.3	---
	52-80	1.0-5.0	---	7.4-8.4	---
464B:					
Mossback--------	0-3	---	10-20	4.5-6.5	0
	3-18	---	2.0-6.0	5.1-6.0	0
	18-24	3.0-9.0	---	6.6-7.8	1-8
	24-74	1.0-3.0	---	7.4-8.4	10-30
	74-80	0.0-2.0	---	7.4-8.4	1-8
464C:					
Mossback--------	0-3	---	10-20	4.5-6.5	0
	3-18	---	2.0-6.0	5.1-6.0	0
	18-24	3.0-9.0	---	6.6-7.8	1-8
	24-74	1.0-3.0	---	7.4-8.4	10-30
	74-80	0.0-2.0	---	7.4-8.4	1-8
464D:					
Mossback--------	0-3	---	10-20	4.5-6.5	0
	3-18	---	2.0-6.0	5.1-6.0	0
	18-24	3.0-9.0	---	6.6-7.8	1-8
	24-74	1.0-3.0	---	7.4-8.4	10-30
	74-80	0.0-2.0	---	7.4-8.4	1-8
464E:					
Mossback--------	0-3	---	10-20	4.5-6.5	0
	3-18	---	2.0-6.0	5.1-6.0	0
	18-24	3.0-9.0	---	6.6-7.8	1-8
	24-74	1.0-3.0	---	7.4-8.4	10-30
	74-80	0.0-2.0	---	7.4-8.4	1-8
465:					
Caffey----------	0-6	100-180	---	5.6-7.3	---
	6-18	1.0-5.0	---	6.6-8.4	0-20
	18-80	2.0-10	---	7.4-8.4	15-30

Table 22.--Water Features

(See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
13:										
Tawas-----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	---	---	---	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
Lupton----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	---	---	---	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
14:										
Dawson----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
Loxley----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	---	---	---	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	*Ft*		*Ft*				
15A:										
Croswell--------	A									
		January	5.0	>6.5	Apparent	---	---	None	---	---
		February	5.0	>6.5	Apparent	---	---	None	---	---
		March	2.5	>6.5	Apparent	---	---	None	---	---
		April	2.0	>6.5	Apparent	---	---	None	---	---
		May	2.0	>6.5	Apparent	---	---	None	---	---
		June	3.5	>6.5	Apparent	---	---	None	---	---
		September	4.5	>6.5	Apparent	---	---	None	---	---
		October	3.0	>6.5	Apparent	---	---	None	---	---
		November	2.5	>6.5	Apparent	---	---	None	---	---
		December	2.0	>6.5	Apparent	---	---	None	---	---
Au Gres---------	B									
		January	1.5	>6.5	Apparent	---	---	None	---	---
		February	1.5	>6.5	Apparent	---	---	None	---	---
		March	1.0	>6.5	Apparent	---	---	None	---	---
		April	0.5	>6.5	Apparent	---	---	None	---	---
		May	0.5	>6.5	Apparent	---	---	None	---	---
		June	1.0	>6.5	Apparent	---	---	None	---	---
		July	2.0	>6.5	Apparent	---	---	None	---	---
		August	3.0	>6.5	Apparent	---	---	None	---	---
		September	2.0	>6.5	Apparent	---	---	None	---	---
		October	1.0	>6.5	Apparent	---	---	None	---	---
		November	1.0	>6.5	Apparent	---	---	None	---	---
		December	1.5	>6.5	Apparent	---	---	None	---	---
16B:										
Graycalm--------	A	All months	>6.5	>6.5	---	---	---	---	---	
17A:										
Croswell--------	A									
		January	5.0	>6.5	Apparent	---	---	None	---	---
		February	5.0	>6.5	Apparent	---	---	None	---	---
		March	2.5	>6.5	Apparent	---	---	None	---	---
		April	2.0	>6.5	Apparent	---	---	None	---	---
		May	2.0	>6.5	Apparent	---	---	None	---	---
		June	3.5	>6.5	Apparent	---	---	None	---	---
		September	4.5	>6.5	Apparent	---	---	None	---	---
		October	3.0	>6.5	Apparent	---	---	None	---	---
		November	2.5	>6.5	Apparent	---	---	None	---	---
		December	2.0	>6.5	Apparent	---	---	None	---	---
17B:										
Croswell--------	A									
		January	5.0	>6.5	Apparent	---	---	None	---	---
		February	5.0	>6.5	Apparent	---	---	None	---	---
		March	2.5	>6.5	Apparent	---	---	None	---	---
		April	2.0	>6.5	Apparent	---	---	None	---	---
		May	2.0	>6.5	Apparent	---	---	None	---	---
		June	3.5	>6.5	Apparent	---	---	None	---	---
		September	4.5	>6.5	Apparent	---	---	None	---	---
		October	3.0	>6.5	Apparent	---	---	None	---	---
		November	2.5	>6.5	Apparent	---	---	None	---	---
		December	2.0	>6.5	Apparent	---	---	None	---	---

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
18A:										
Au Gres---------	B									
		January	1.5	>6.5	Apparent	---	---	None	---	---
		February	1.5	>6.5	Apparent	---	---	None	---	---
		March	1.0	>6.5	Apparent	---	---	None	---	---
		April	0.5	>6.5	Apparent	---	---	None	---	---
		May	0.5	>6.5	Apparent	---	---	None	---	---
		June	1.0	>6.5	Apparent	---	---	None	---	---
		July	2.0	>6.5	Apparent	---	---	None	---	---
		August	3.0	>6.5	Apparent	---	---	None	---	---
		September	2.0	>6.5	Apparent	---	---	None	---	---
		October	1.0	>6.5	Apparent	---	---	None	---	---
		November	1.0	>6.5	Apparent	---	---	None	---	---
		December	1.5	>6.5	Apparent	---	---	None	---	---
19:										
Leafriver-------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		July	0.5	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		August	0.5	>6.5	Apparent	---	Very long	Frequent	---	---
		September	0.0	>6.5	Apparent	---	Very long	Frequent	---	---
		October	0.0	>6.5	Apparent	---	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
20B, 20D, 20F:										
Graycalm--------	A	All months	>6.5	>6.5	---	---	---	---	---	
Grayling--------	A	All months	>6.5	>6.5	---	---	---	---	---	
23:										
Ausable---------	D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		June	0.0	>6.5	Apparent	---	---	---	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	---	---	---	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
23:										
Bowstring-------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		June	0.0	>6.5	Apparent	---	---	---	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	---	---	---	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	Long	Frequent
24A:										
Kinross---------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		June	0.5	>6.5	Apparent	---	---	---	---	---
		July	1.5	>6.5	Apparent	---	---	---	---	---
		August	2.0	>6.5	Apparent	---	---	---	---	---
		September	1.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
Au Gres---------	B									
		January	1.5	>6.5	Apparent	---	---	None	---	---
		February	1.5	>6.5	Apparent	---	---	None	---	---
		March	1.0	>6.5	Apparent	---	---	None	---	---
		April	0.5	>6.5	Apparent	---	---	None	---	---
		May	0.5	>6.5	Apparent	---	---	None	---	---
		June	1.0	>6.5	Apparent	---	---	None	---	---
		July	2.0	>6.5	Apparent	---	---	None	---	---
		August	3.0	>6.5	Apparent	---	---	None	---	---
		September	2.0	>6.5	Apparent	---	---	None	---	---
		October	1.0	>6.5	Apparent	---	---	None	---	---
		November	1.0	>6.5	Apparent	---	---	None	---	---
		December	1.5	>6.5	Apparent	---	---	None	---	---
25B:										
Kent------------	D									
		March	2.0	3.5	Perched	---	---	None	---	---
		April	2.0	3.5	Perched	---	---	None	---	---
		May	2.0	3.5	Perched	---	---	None	---	---
		October	2.0	3.5	Perched	---	---	None	---	---
		November	2.0	3.5	Perched	---	---	None	---	---
25C:										
Kent------------	D									
		March	2.0	3.5	Perched	---	---	None	---	---
		April	2.0	3.5	Perched	---	---	None	---	---
		May	2.0	3.5	Perched	---	---	None	---	---
		October	2.0	3.5	Perched	---	---	None	---	---
		November	2.0	3.5	Perched	---	---	None	---	---

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	*Ft*		*Ft*				
28B, 28C, 28E:										
East Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
32B:										
Kellogg---------	B									
		March	2.5	3.5	Perched	---	---	None	---	---
		April	2.5	3.5	Perched	---	---	None	---	---
		May	2.5	3.5	Perched	---	---	None	---	---
		September	2.5	3.5	Perched	---	---	None	---	---
		October	2.5	3.5	Perched	---	---	None	---	---
		November	2.5	3.5	Perched	---	---	None	---	---
33B, 33C, 33D, 33E:										
Mancelona------	A	All months	>6.5	>6.5	---	---	---	---	---	
47D, 47F:										
Graycalm--------	A	All months	>6.5	>6.5	---	---	---	---	---	
49B:										
Kalkaska--------	A	All months	>6.5	>6.5	---	---	---	---	---	
50B:										
Au Gres---------	B									
		January	1.5	>6.5	Apparent	---	---	None	---	---
		February	1.5	>6.5	Apparent	---	---	None	---	---
		March	1.0	>6.5	Apparent	---	---	None	---	---
		April	0.5	>6.5	Apparent	---	---	None	---	---
		May	0.5	>6.5	Apparent	---	---	None	---	---
		June	1.0	>6.5	Apparent	---	---	None	---	---
		July	2.0	>6.5	Apparent	---	---	None	---	---
		August	3.0	>6.5	Apparent	---	---	None	---	---
		September	2.0	>6.5	Apparent	---	---	None	---	---
		October	1.0	>6.5	Apparent	---	---	None	---	---
		November	1.0	>6.5	Apparent	---	---	None	---	---
		December	1.5	>6.5	Apparent	---	---	None	---	---
Kinross---------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		June	0.5	>6.5	Apparent	---	---	---	---	---
		July	1.5	>6.5	Apparent	---	---	---	---	---
		August	2.0	>6.5	Apparent	---	---	---	---	---
		September	1.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---

Table 22.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
50B:										
Croswell--------	A									
		January	5.0	>6.5	Apparent	---	---	None	---	---
		February	5.0	>6.5	Apparent	---	---	None	---	---
		March	2.5	>6.5	Apparent	---	---	None	---	---
		April	2.0	>6.5	Apparent	---	---	None	---	---
		May	2.0	>6.5	Apparent	---	---	None	---	---
		June	3.5	>6.5	Apparent	---	---	None	---	---
		September	4.5	>6.5	Apparent	---	---	None	---	---
		October	3.0	>6.5	Apparent	---	---	None	---	---
		November	2.5	>6.5	Apparent	---	---	None	---	---
		December	2.0	>6.5	Apparent	---	---	None	---	---
51:										
Tawas-----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	---	---	---	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
Leafriver-------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		July	0.5	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		August	0.5	>6.5	Apparent	---	Very long	Frequent	---	---
		September	0.0	>6.5	Apparent	---	Very long	Frequent	---	---
		October	0.0	>6.5	Apparent	---	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
52B, 52D, 52E:										
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
64B:										
Feldhauser------	B	April	2.0	3.5	Perched	---	---	None	---	---
		October	2.0	3.5	Perched	---	---	None	---	---
65F, 75B, 75D, 75E:										
Rubicon--------	A	All months	>6.5	>6.5	---	---	---	---	---	
78:										
Pits, borrow.										
81B, 81D, 81E, 81F:										
Grayling-------	A	All months	>6.5	>6.5	---	---	---	---	---	

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	*Ft*		*Ft*				
82B:										
Udorthents------	---	All months	>6.5	>6.5	---	---	---	---	---	
83B:										
Udipsamments----	A	All months	>6.5	>6.5	---	---	---	---	---	
86:										
Histosols-------	D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		June	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		July	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		August	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		September	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	---	---	---
Aquents---------	D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		July	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		August	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		September	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
90B:										
Chinwhisker-----	A									
		January	5.0	>6.5	Apparent	---	---	None	---	---
		February	5.0	>6.5	Apparent	---	---	None	---	---
		March	2.5	>6.5	Apparent	---	---	None	---	---
		April	2.0	>6.5	Apparent	---	---	None	---	---
		May	2.0	>6.5	Apparent	---	---	None	---	---
		June	3.5	>6.5	Apparent	---	---	None	---	---
		September	4.5	>6.5	Apparent	---	---	None	---	---
		October	3.0	>6.5	Apparent	---	---	None	---	---
		November	2.5	>6.5	Apparent	---	---	None	---	---
		December	2.0	>6.5	Apparent	---	---	None	---	---
95D, 95E:										
Menominee-------	A	All months	>6.5	>6.5	---	---	---	---	---	

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
113:										
Angelica--------	B/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		June	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		July	1.5	>6.5	Apparent	---	---	---	---	---
		August	1.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
115D:										
Kalkaska--------	A	All months	>6.5	>6.5	---	---	---	---	---	
116B:										
Mancelona-------	A	All months	>6.5	>6.5	---	---	---	---	---	
126F:										
Udipsamments----	A	All months	>6.5	>6.5	---	---	---	---	---	
Haplorthods-----	---	All months	>6.5	>6.5	---	---	---	---	---	
Glossudalfs-----	---	All months	>6.5	>6.5	---	---	---	---	---	
127:										
Cathro----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		June	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		July	0.5	>6.5	Apparent	---	---	---	---	---
		August	0.5	>6.5	Apparent	---	---	---	---	---
		September	0.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	---	---	---	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Very long	Frequent	---	---
141B, 141C, 141D:										
Leelanau--------	A	All months	>6.5	>6.5	---	---	---	---	---	
146F:										
Rubicon---------	A	All months	>6.5	>6.5	---	---	---	---	---	
Graycalm--------	A	All months	>6.5	>6.5	---	---	---	---	---	
147B, 141C, 141D, 147E:										
Lindquist------	A	All months	>6.5	>6.5	---	---	---	---	---	

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
166A:										
Slade-----------	C									
		January	1.0	1.5	Perched	---	---	None	---	---
		February	1.0	1.5	Perched	---	---	None	---	---
		March	0.5	2.5	Perched	---	---	None	---	---
		April	0.5	2.5	Perched	---	---	None	---	---
		May	0.5	2.5	Perched	---	---	None	---	---
		October	0.5	2.5	Perched	---	---	None	---	---
		November	0.5	2.5	Perched	---	---	None	---	---
		December	1.0	1.5	Perched	---	---	None	---	---
197A:										
Gladwin---------	A									
		January	1.5	>6.5	Apparent	---	---	None	---	---
		February	1.5	>6.5	Apparent	---	---	None	---	---
		March	1.0	>6.5	Apparent	---	---	None	---	---
		April	0.5	>6.5	Apparent	---	---	None	---	---
		May	0.5	>6.5	Apparent	---	---	None	---	---
		June	1.0	>6.5	Apparent	---	---	None	---	---
		July	2.0	>6.5	Apparent	---	---	None	---	---
		August	3.0	>6.5	Apparent	---	---	None	---	---
		September	2.0	>6.5	Apparent	---	---	None	---	---
		October	1.0	>6.5	Apparent	---	---	None	---	---
		November	1.0	>6.5	Apparent	---	---	None	---	---
		December	1.5	>6.5	Apparent	---	---	None	---	---
323B, 323C:										
East Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
Rubicon---------	A	All months	>6.5	>6.5	---	---	---	---	---	
337B, 337C:										
Mancelona-------	A	All months	>6.5	>6.5	---	---	---	---	---	
East Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
338B, 388C, 388D:										
Islandlake------	A	All months	>6.5	>6.5	---	---	---	---	---	
347F:										
Kalkaska--------	A	All months	>6.5	>6.5	---	---	---	---	---	
349B:										
Hartwick--------	A	All months	>6.5	>6.5	---	---	---	---	---	
350D:										
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table			Ponding			Flooding	
			Upper limit	Lower limit	Kind	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	*Ft*		*Ft*				
352B:										
Deford----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		June	0.5	>6.5	Apparent	---	---	---	---	---
		July	1.5	>6.5	Apparent	---	---	---	---	---
		August	1.0	>6.5	Apparent	---	---	---	---	---
		September	1.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
Au Gres---------	B									
		January	1.5	>6.5	Apparent	---	---	None	---	---
		February	1.5	>6.5	Apparent	---	---	None	---	---
		March	1.0	>6.5	Apparent	---	---	None	---	---
		April	0.5	>6.5	Apparent	---	---	None	---	---
		May	0.5	>6.5	Apparent	---	---	None	---	---
		June	1.0	>6.5	Apparent	---	---	None	---	---
		July	2.0	>6.5	Apparent	---	---	None	---	---
		August	3.0	>6.5	Apparent	---	---	None	---	---
		September	2.0	>6.5	Apparent	---	---	None	---	---
		October	1.0	>6.5	Apparent	---	---	None	---	---
		November	1.0	>6.5	Apparent	---	---	None	---	---
		December	1.5	>6.5	Apparent	---	---	None	---	---
Croswell--------	A									
		January	5.0	>6.5	Apparent	---	---	None	---	---
		February	5.0	>6.5	Apparent	---	---	None	---	---
		March	2.5	>6.5	Apparent	---	---	None	---	---
		April	2.0	>6.5	Apparent	---	---	None	---	---
		May	2.0	>6.5	Apparent	---	---	None	---	---
		June	3.5	>6.5	Apparent	---	---	None	---	---
		September	4.5	>6.5	Apparent	---	---	None	---	---
		October	3.0	>6.5	Apparent	---	---	None	---	---
		November	2.5	>6.5	Apparent	---	---	None	---	---
		December	2.0	>6.5	Apparent	---	---	None	---	---
354F:										
Mancelona-------	A	All months	>6.5	>6.5	---	---	---	---	---	
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
360:										
Wakeley---------	D									
		January	0.0	2.5	Perched	0.0-1.0	Long	Frequent	---	---
		February	0.0	2.5	Perched	0.0-1.0	Long	Frequent	---	---
		March	0.0	2.5	Perched	0.0-1.0	Long	Frequent	---	---
		April	0.0	2.5	Perched	0.0-1.0	Long	Frequent	---	---
		May	0.5	2.5	Perched	0.0-1.0	Long	Frequent	---	---
		June	1.5	2.5	Perched	---	---	---	---	---
		September	0.0	2.5	Perched	---	---	---	---	---
		October	0.0	2.5	Perched	0.0-1.0	Long	Frequent	---	---
		November	0.0	2.5	Perched	0.0-1.0	Long	Frequent	---	---
		December	0.0	2.5	Perched	0.0-1.0	Long	Frequent	---	---

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
362D:										
Millersburg-----	B	All months	>6.5	>6.5	---	---	---	---	---	
365F:										
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
368A:										
Au Gres---------	B									
		January	1.5	>6.5	Apparent	---	---	None	---	---
		February	1.5	>6.5	Apparent	---	---	None	---	---
		March	1.0	>6.5	Apparent	---	---	None	---	---
		April	0.5	>6.5	Apparent	---	---	None	---	---
		May	0.5	>6.5	Apparent	---	---	None	---	---
		June	1.0	>6.5	Apparent	---	---	None	---	---
		July	2.0	>6.5	Apparent	---	---	None	---	---
		August	3.0	>6.5	Apparent	---	---	None	---	---
		September	2.0	>6.5	Apparent	---	---	None	---	---
		October	1.0	>6.5	Apparent	---	---	None	---	---
		November	1.0	>6.5	Apparent	---	---	None	---	---
		December	1.5	>6.5	Apparent	---	---	None	---	---
Deford----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		June	0.5	>6.5	Apparent	---	---	---	---	---
		July	1.5	>6.5	Apparent	---	---	---	---	---
		August	1.0	>6.5	Apparent	---	---	---	---	---
		September	1.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
369:										
Deford----------	A/D									
		January	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		June	0.5	>6.5	Apparent	---	---	---	---	---
		July	1.5	>6.5	Apparent	---	---	---	---	---
		August	1.0	>6.5	Apparent	---	---	---	---	---
		September	1.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
380:										
Access denied.										
387F:										
Mancelona-------	A	All months	>6.5	>6.5	---	---	---	---	---	
Rubicon---------	A	All months	>6.5	>6.5	---	---	---	---	---	

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro- logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	*Ft*		*Ft*				
393B:										
Morganlake------	B									
		March	1.5	3.5	Perched	---	---	None	---	---
		April	1.5	3.5	Perched	---	---	None	---	---
		May	1.5	3.5	Perched	---	---	None	---	---
		September	1.5	3.5	Perched	---	---	None	---	---
		October	1.5	3.5	Perched	---	---	None	---	---
		November	1.5	3.5	Perched	---	---	None	---	---
393C:										
Morganlake------	B									
		March	1.5	3.5	Perched	---	---	None	---	---
		April	1.5	3.5	Perched	---	---	None	---	---
		May	1.5	3.5	Perched	---	---	None	---	---
		September	1.5	3.5	Perched	---	---	None	---	---
		October	1.5	3.5	Perched	---	---	None	---	---
		November	1.5	3.5	Perched	---	---	None	---	---
399D:										
Menominee-------	A	All months	>6.5	>6.5	---	---	---	---	---	
Bamfield--------	C	All months	>6.5	>6.5	---	---	---	---	---	
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
400F:										
Menominee-------	A	All months	>6.5	>6.5	---	---	---	---	---	
Bamfield--------	C	All months	>6.5	>6.5	---	---	---	---	---	
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
401F:										
Lindquist-------	A	All months	>6.5	>6.5	---	---	---	---	---	
402B, 402C, 402D:										
Islandlake------	A	All months	>6.5	>6.5	---	---	---	---	---	
424B:										
Morganlake------	B									
		March	1.5	3.5	Perched	---	---	None	---	---
		April	1.5	3.5	Perched	---	---	None	---	---
		May	1.5	3.5	Perched	---	---	None	---	---
		September	1.5	3.0	Perched	---	---	None	---	---
		October	1.5	3.5	Perched	---	---	None	---	---
		November	1.5	3.5	Perched	---	---	None	---	---
Ossineke--------	B									
		March	1.5	3.5	Perched	---	---	None	---	---
		April	1.5	3.5	Perched	---	---	None	---	---
		May	1.5	3.5	Perched	---	---	None	---	---
		October	1.5	3.5	Perched	---	---	None	---	---
		November	1.5	3.5	Perched	---	---	None	---	---
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	

Table 22.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Water table: Kind	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft		Ft				
424C:										
Morganlake------	B									
		March	1.5	3.5	Perched	---	---	None	---	---
		April	1.5	3.5	Perched	---	---	None	---	---
		May	1.5	3.5	Perched	---	---	None	---	---
		September	1.5	3.5	Perched	---	---	None	---	---
		October	1.5	3.5	Perched	---	---	None	---	---
		November	1.5	3.5	Perched	---	---	None	---	---
Ossineke--------	B									
		March	1.5	3.5	Perched	---	---	None	---	---
		April	1.5	3.5	Perched	---	---	None	---	---
		May	1.5	3.5	Perched	---	---	None	---	---
		October	1.5	3.5	Perched	---	---	None	---	---
		November	1.5	3.5	Perched	---	---	None	---	---
Blue Lake-------	A	All months	>6.5	>6.5	---	---	---	---	---	
452D, 452E:										
Bamfield--------	C	All months	>6.5	>6.5	---	---	---	---	---	
453B, 453C:										
Ossineke--------	B									
		March	1.5	3.5	Perched	---	---	None	---	---
		April	1.5	3.5	Perched	---	---	None	---	---
		May	1.5	3.5	Perched	---	---	None	---	---
		October	1.5	3.5	Perched	---	---	None	---	---
		November	1.5	3.5	Perched	---	---	None	---	---
463F:										
Leelanau--------	A	All months	>6.5	>6.5	---	---	---	---	---	
464B, 464C, 464D, 464E:										
Mossback-------	B	All months	>6.5	>6.5	---	---	---	---	---	
465:										
Caffey----------	C									
		January	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		February	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		March	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		April	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		May	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		June	0.5	>6.5	Apparent	---	---	---	---	---
		July	1.5	>6.5	Apparent	---	---	---	---	---
		August	2.0	>6.5	Apparent	---	---	---	---	---
		September	1.0	>6.5	Apparent	---	---	---	---	---
		October	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		November	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---
		December	0.0	>6.5	Apparent	0.0-1.0	Long	Frequent	---	---

Table 23.--Soil Moisture Status by Depth

(Depth of layers is in feet. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
13:													
Tawas	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Lupton	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
14:													
Dawson	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Loxley	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
15A:													
Croswell	A	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
Au Gres	B	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
16B:													
Graycalm	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
17A:													
Croswell--------	A	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
17B:													
Croswell--------	A	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
18A:													
Au Gres---------	B	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
19:													
Leafriver-------	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
20B:													
Graycalm--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Grayling--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
20D:													
Graycalm--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Grayling--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
20F:													
Graycalm	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Grayling	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
23:													
Ausable	D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Bowstring	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
24A:													
Kinross	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Au Gres	B	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
25B:													
Kent	D	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-2.0: Moist 2.0-3.5: Wet 3.5-6.5: Moist	0.0-2.0: Moist 2.0-3.5: Wet 3.5-6.5: Moist	0.0-2.0: Moist 2.0-3.5: Wet 3.5-6.5: Moist	0.0-0.5: Dry 0.5-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-2.0: Moist 2.0-3.5: Wet 3.5-6.5: Moist	0.0-2.0: Moist 2.0-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro- logic group	January	February	March	April	May	June	July	August	September	October	November	December
25C:													
Kent------------	D	0.0-6.5:	0.0-6.5:	0.0-2.0:	0.0-2.0:	0.0-2.0:	0.0-0.5:	0.0-1.0:	0.0-1.0:	0.0-6.5:	0.0-2.0:	0.0-2.0:	0.0-6.5:
		Moist	Moist	Moist	Moist	Moist	Dry	Dry	Dry	Moist	Moist	Moist	Moist
		---	---	2.0-3.5:	2.0-3.5:	2.0-3.5:	0.5-6.5:	1.0-6.5:	1.0-6.5:	---	2.0-3.5:	2.0-3.5:	---
				Wet	Wet	Wet	Moist	Moist	Moist		Wet	Wet	
		---	---	3.5-6.5:	3.5-6.5:	3.5-6.5:	---	---	---	---	3.5-6.5:	3.5-6.5:	---
				Moist	Moist	Moist					Moist	Moist	
28B:													
East Lake-------	A	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-2.0:	0.0-3.0:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:
		Moist	Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist	Moist	Moist	Moist
		---	---	---	---	---	---	2.0-6.5:	3.0-6.5:	---	---	---	---
								Moist	Moist				
28C:													
East Lake-------	A	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-2.0:	0.0-3.0:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:
		Moist	Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist	Moist	Moist	Moist
		---	---	---	---	---	---	2.0-6.5:	3.0-6.5:	---	---	---	---
								Moist	Moist				
28E:													
East Lake-------	A	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-2.0:	0.0-3.0:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:
		Moist	Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist	Moist	Moist	Moist
		---	---	---	---	---	---	2.0-6.5:	3.0-6.5:	---	---	---	---
								Moist	Moist				
32B:													
Kellogg---------	B	0.0-6.5:	0.0-6.5:	0.0-2.5:	0.0-2.5:	0.0-2.5:	0.0-6.5:	0.0-1.0:	0.0-2.0:	0.0-2.5:	0.0-2.5:	0.0-2.5:	0.0-6.5:
		Moist	Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist	Moist	Moist	Moist
		---	---	2.5-3.5:	2.5-3.5:	2.5-3.5:	---	1.0-6.5:	2.0-6.5:	2.5-3.5:	2.5-3.5:	2.5-3.5:	---
				Wet	Wet	Wet		Moist	Moist	Wet	Wet	Wet	
		---	---	3.5-6.5:	3.5-6.5:	3.5-6.5:	---	---	---	3.5-6.5:	3.5-6.5:	3.5-6.5:	---
				Moist	Moist	Moist				Moist	Moist	Moist	
33B:													
Mancelona-------	A	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-2.0:	0.0-3.0:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:
		Moist	Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist	Moist	Moist	Moist
		---	---	---	---	---	---	2.0-6.5:	3.0-6.5:	---	---	---	---
								Moist	Moist				
33C:													
Mancelona-------	A	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-2.0:	0.0-3.0:	0.0-6.5:	0.0-6.5:	0.0-6.5:	0.0-6.5:
		Moist	Moist	Moist	Moist	Moist	Moist	Dry	Dry	Moist	Moist	Moist	Moist
		---	---	---	---	---	---	2.0-6.5:	3.0-6.5:	---	---	---	---
								Moist	Moist				

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydrologic group	January	February	March	April	May	June	July	August	September	October	November	December
33D:													
Mancelona-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
33E:													
Mancelona-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
47D:													
Graycalm--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
47F:													
Graycalm--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
49B:													
Kalkaska--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
50B:													
Au Gres---------	B	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
Kinross---------	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Croswell--------	A	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
51:													
Tawas-----------	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
Leafriver-------	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
52B:													
Blue Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
52D:													
Blue Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
52E:													
Blue Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
64B:													
Feldhauser------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-2.0: Moist 2.0-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-2.0: Moist 2.0-3.5: Wet 4.0-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---
65F:													
Rubicon---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro- logic group	January	February	March	April	May	June	July	August	September	October	November	December
75B: Rubicon---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
75D: Rubicon---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
75E: Rubicon---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
78: Pits, borrow.													
81B: Grayling--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
81D: Grayling--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
81E: Grayling--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
81F: Grayling--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
82B: Udorthents.													

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
83B:													
Udipsamments----	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
86:													
Histosols-------	D	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet	0.0-6.0: Wet
Aquents---------	D	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet	0.0-6.5: Wet
90B:													
Chinwhisker-----	A	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
95D:													
Menominee-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
95E:													
Menominee-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
113:													
Angelica--------	B/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
115D:													
Kalkaska--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
116B:													
Mancelona-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
126F:													
Udipsamments----	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Haplorthods-----	---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Glossudalfs.													
127:													
Cathro----------	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-0.5: Moist 0.5-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
141B:													
Leelanau--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
141C:													
Leelanau--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
141D:													
Leelanau--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
146F:													
Rubicon----------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Graycalm---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
147B:													
Lindquist--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
147C:													
Lindquist--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
147D:													
Lindquist--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
147E:													
Lindquist--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
166A:													
Slade------------	C	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist	0.0-0.5: Moist 0.5-2.5: Wet 2.5-6.5: Moist	0.0-0.5: Moist 0.5-2.5: Wet 2.5-6.5: Moist	0.0-0.5: Moist 0.5-2.5: Wet 2.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-0.5: Dry 0.5-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-0.5: Moist 0.5-2.5: Wet 2.5-6.5: Moist	0.0-0.5: Moist 0.5-2.5: Wet 2.5-6.5: Moist	0.0-1.0: Moist 1.0-1.5: Wet 1.5-6.5: Moist

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
197A:													
Gladwin---------	A	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
323B:													
East Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Rubicon---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
323C:													
East Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Rubicon---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
337B:													
Mancelona-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
East Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
337C:													
Mancelona-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydrologic group	January	February	March	April	May	June	July	August	September	October	November	December
337C: East Lake	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
338B: Islandlake	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
338C: Islandlake	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
338D: Islandlake	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
347F: Kalkaska	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
349B: Hartwick	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
350D: Blue Lake	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
352B: Deford	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
352B:													
Au Gres	B	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
Croswell	A	0.0-5.0: Moist 5.0-6.5: Wet	0.0-5.0: Moist 5.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-3.5: Moist 3.5-6.5: Wet	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-4.5: Moist 4.5-6.5: Wet	0.0-3.0: Moist 3.0-6.5: Wet	0.0-2.5: Moist 2.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet
354F:													
Mancelona	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Blue Lake	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
360:													
Wakeley	D	0.0-2.5: Wet 2.5-6.5: Moist ---	0.0-2.5: Wet 2.5-6.5: Moist ---	0.0-2.5: Wet 2.5-6.5: Moist ---	0.0-2.5: Wet 2.5-6.5: Moist ---	0.0-0.5: Moist 0.5-2.5: Wet 2.5-6.5: Moist	0.0-1.5: Moist 1.5-2.5: Wet 2.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-2.5: Wet 2.5-6.5: Moist ---	0.0-2.5: Wet 2.5-6.5: Moist ---	0.0-2.5: Wet 2.5-6.5: Moist ---	0.0-2.5: Wet 2.5-6.5: Moist ---
362D:													
Millersburg	B	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
365F:													
Blue Lake	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
368A:													
Au Gres---------	B	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Dry 1.0-3.0: Moist 3.0-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.0: Moist 1.0-6.5: Wet ---	0.0-1.5: Moist 1.5-6.5: Wet ---
Deford----------	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
369:													
Deford----------	A/D	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---
380:													
Access denied.													
387F:													
Mancelona-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Rubicon---------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
393B:													
Morganlake------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
393C:													
Morganlake------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---
399D:													
Menominee-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Bamfield--------	C	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Blue Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
400F:													
Menominee-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Bamfield--------	C	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
Blue Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
401F:													
Lindquist-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
402B:													
Islandlake------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
402C:													
Islandlake------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
402D:													
Islandlake------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
424B:													
Morganlake------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---
Ossineke--------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-0.5: Dry 0.5-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---
Blue Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
424C:													
Morganlake------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydro-logic group	January	February	March	April	May	June	July	August	September	October	November	December
424C:													
Ossineke--------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-0.5: Dry 0.5-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---
Blue Lake-------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
452D:													
Bamfield--------	C	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
452E:													
Bamfield--------	C	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
453B:													
Ossineke--------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-0.5: Dry 0.5-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---
453C:													
Ossineke--------	B	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-0.5: Dry 0.5-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist ---	0.0-6.5: Moist --- ---	0.0-6.5: Moist --- ---	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-1.5: Moist 1.5-3.5: Wet 3.5-6.5: Moist	0.0-6.5: Moist --- ---
463F:													
Leelanau--------	A	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-2.0: Dry 2.0-6.5: Moist	0.0-3.0: Dry 3.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---

Table 23.--Soil Moisture Status by Depth--Continued

Map symbol and soil name	Hydrologic group	January	February	March	April	May	June	July	August	September	October	November	December
464B: Mossback--------	B	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
464C: Mossback--------	B	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
464D: Mossback--------	B	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
464E: Mossback--------	B	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-1.0: Dry 1.0-6.5: Moist	0.0-1.0: Dry 1.0-6.5: Moist	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---	0.0-6.5: Moist ---
465: Caffey----------	C	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-0.5: Moist 0.5-6.5: Wet	0.0-1.5: Moist 1.5-6.5: Wet	0.0-2.0: Moist 2.0-6.5: Wet	0.0-1.0: Moist 1.0-6.5: Wet	0.0-6.5: Wet ---	0.0-6.5: Wet ---	0.0-6.5: Wet ---

Table 24.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Subsidence		Potential for frost action	Risk of corrosion	
	Initial	Total		Uncoated steel	Concrete
	In	*In*			
13:					
Tawas	4-15	25-30	High	High	Moderate.
Lupton	6-18	50-55	High	High	Low.
14:					
Dawson	---	30-36	High	High	High.
Loxley	6-18	50-55	High	High	High.
15A:					
Croswell	---	---	Low	Low	Moderate.
Au Gres	---	---	Moderate	Low	Moderate.
16B:					
Graycalm	---	---	Low	Low	Moderate.
17A:					
Croswell	---	---	Low	Low	Moderate.
17B:					
Croswell	---	---	Low	Low	Moderate.
18A:					
Au Gres	---	---	Moderate	Low	Moderate.
19:					
Leafriver	---	5-10	High	High	High.
20B:					
Graycalm	---	---	Low	Low	Moderate.
Grayling	---	---	Low	Low	Moderate.
20D:					
Graycalm	---	---	Low	Low	Moderate.
Grayling	---	---	Low	Low	Moderate.
20F:					
Graycalm	---	---	Low	Low	Moderate.
Grayling	---	---	Low	Low	Moderate.
23:					
Ausable	---	---	Moderate	High	Low.
Bowstring		20-30	High	High	Low.
24A:					
Kinross	---	---	Moderate	High	Moderate.
Au Gres	---	---	Moderate	Low	Moderate.
25B:					
Kent	---	---	Moderate	High	Low.

Table 24.--Soil Features--Continued

Map symbol and soil name	Subsidence		Potential for frost action	Risk of corrosion	
	Initial	Total		Uncoated steel	Concrete
	In	*In*			
25C:					
Kent	---	---	Moderate	High	Low.
28B:					
East Lake	---	---	Low	Low	Moderate.
28C:					
East Lake	---	---	Low	Low	Moderate.
28E:					
East Lake	---	---	Low	Low	Moderate.
32B:					
Kellogg	---	---	Low	High	Moderate.
33B:					
Mancelona	---	---	Low	Low	Low.
33C:					
Mancelona	---	---	Low	Low	Low.
33D:					
Mancelona	---	---	Low	Low	Low.
33E:					
Mancelona	---	---	Low	Low	Low.
47D:					
Graycalm	---	---	Low	Low	Moderate.
47F:					
Graycalm	---	---	Low	Low	Moderate.
49B:					
Kalkaska	---	---	Low	Low	High.
50B:					
Au Gres	---	---	Moderate	Low	Moderate.
Kinross	---	---	Moderate	High	Moderate.
Croswell	---	---	Low	Low	Moderate.
51:					
Tawas	4-15	25-30	High	High	Moderate.
Leafriver	---	5-10	High	High	High.
52B:					
Blue Lake	---	---	Low	Low	Moderate.
52D:					
Blue Lake	---	---	Low	Low	Moderate.
52E:					
Blue Lake	---	---	Low	Low	Moderate.
64B:					
Feldhauser	---	---	Moderate	Low	Moderate.
65F:					
Rubicon	---	---	Low	Low	High.

Table 24.--Soil Features--Continued

Map symbol and soil name	Subsidence		Potential for frost action	Risk of corrosion	
	Initial	Total		Uncoated steel	Concrete
	In	*In*			
75B:					
Rubicon	---	---	Low	Low	High.
75D:					
Rubicon	---	---	Low	Low	High.
75E:					
Rubicon	---	---	Low	Low	High.
78:					
Pits, borrow.					
81B:					
Grayling	---	---	Low	Low	Moderate.
81D:					
Grayling	---	---	Low	Low	Moderate.
81E:					
Grayling	---	---	Low	Low	Moderate.
81F:					
Grayling	---	---	Low	Low	Moderate.
82B:					
Udorthents.					
83B:					
Udipsamments	---	---	Low	Low	Moderate.
86:					
Histosols	---	---	High	---	---
Aquents	---	---	High	---	---
90B:					
Chinwhisker		---	Low	Low	Moderate.
95D:					
Menominee	---	---	Low	Low	Moderate.
95E:					
Menominee	---	---	Low	Low	Moderate.
113:					
Angelica	---	---	High	High	Low.
115D:					
Kalkaska	---	---	Low	Low	High.
116B:					
Mancelona	---	---	Low	Low	Low.
126F:					
Udipsamments	---	---	Low	Low	Moderate.
Haplorthods.					
Glossudalfs.					
127:					
Cathro	4-12	19-22	High	High	Low.

Table 24.--Soil Features--Continued

Map symbol and soil name	Subsidence		Potential for frost action	Risk of corrosion	
	Initial	Total		Uncoated steel	Concrete
	In	*In*			
141B:					
Leelanau	---	---	Low	Low	Low.
141C:					
Leelanau	---	---	Low	Low	Low.
141D:					
Leelanau	---	---	Low	Low	Low.
146F:					
Rubicon	---	---	Low	Low	High.
Graycalm	---	---	Low	Low	Moderate.
147B:					
Lindquist	---	---	Low	Low	Moderate.
147C:					
Lindquist	---	---	Low	Low	Moderate.
147D:					
Lindquist	---	---	Low	Low	Moderate.
147E:					
Lindquist	---	---	Low	Low	Moderate.
166A:					
Slade	---	---	High	Moderate	Moderate.
197A:					
Gladwin	---	---	Moderate	Low	Low.
323B:					
East Lake	---	---	Low	Low	Moderate.
Rubicon	---	---	Low	Low	High.
323C:					
East Lake	---	---	Low	Low	Moderate.
Rubicon	---	---	Low	Low	High.
337B:					
Mancelona	---	---	Low	Low	Low.
East Lake	---	---	Low	Low	Moderate.
337C:					
Mancelona	---	---	Low	Low	Low.
East Lake	---	---	Low	Low	Moderate.
338B:					
Islandlake	---	---	Low	Low	High.
338C:					
Islandlake	---	---	Low	Low	High.
338D:					
Islandlake	---	---	Low	Low	High.

Table 24.--Soil Features--Continued

Map symbol and soil name	Subsidence		Potential for frost action	Risk of corrosion	
	Initial	Total		Uncoated steel	Concrete
	In	*In*			
347F:					
Kalkaska	---	---	Low	Low	High.
349B:					
Hartwick	---	---	Low	Low	Moderate.
350D:					
Blue Lake	---	---	Low	Low	Moderate.
352B:					
Deford	---	---	Moderate	Low	Moderate.
Au Gres	---	---	Moderate	Low	Moderate.
Croswell	---	---	Low	Low	Moderate.
354F:					
Mancelona	---	---	Low	Low	Low.
Blue Lake	---	---	Low	Low	Moderate.
360:					
Wakeley	---	---	Moderate	High	Moderate.
362D:					
Millersburg	---	---	Moderate	Low	Moderate.
365F:					
Blue Lake	---	---	Low	Low	Moderate.
368A:					
Au Gres	---	---	Moderate	Low	Moderate.
Deford	---	---	Moderate	Low	Moderate.
369:					
Deford	---	---	Moderate	Low	Moderate.
380:					
Access denied.					
387F:					
Mancelona	---	---	Low	Low	Low.
Rubicon	---	---	Low	Low	High.
393B:					
Morganlake	---	---	Low	Low	Moderate.
393C:					
Morganlake	---	---	Low	Low	Moderate.
399D:					
Menominee	---	---	Low	Low	Moderate.
Bamfield	---	---	Moderate	Moderate	Moderate.
Blue Lake	---	---	Low	Low	Moderate.
400F:					
Menominee	---	---	Low	Low	Moderate.

Table 24.--Soil Features--Continued

Map symbol and soil name	Subsidence: Initial	Subsidence: Total	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
	In	In			
400F:					
Bamfield	---	---	Moderate	Moderate	Moderate.
Blue Lake	---	---	Low	Low	Moderate.
401F:					
Lindquist	---	---	Low	Low	Moderate.
402B:					
Islandlake	---	---	Low	Low	High.
402C:					
Islandlake	---	---	Low	Low	High.
402D:					
Islandlake	---	---	Low	Low	High.
424B:					
Morganlake	---	---	Low	Low	Moderate.
Ossineke	---	---	Moderate	Moderate	Moderate.
Blue Lake	---	---	Low	Low	Moderate.
424C:					
Morganlake	---	---	Low	Low	Moderate.
Ossineke	---	---	Moderate	Moderate	Moderate.
Blue Lake	---	---	Low	Low	Moderate.
452D:					
Bamfield	---	---	Moderate	Moderate	Moderate.
452E:					
Bamfield	---	---	Moderate	Moderate	Moderate.
453B:					
Ossineke	---	---	Moderate	Moderate	Moderate.
453C:					
Ossineke	---	---	Moderate	Moderate	Moderate.
463F:					
Leelanau	---	---	Low	Low	Low.
464B:					
Mossback	---	---	Moderate	Low	Moderate.
464C:					
Mossback	---	---	Moderate	Low	Moderate.
464D:					
Mossback	---	---	Moderate	Low	Moderate.
464E:					
Mossback	---	---	Moderate	Low	Moderate.
465:					
Caffey	---	---	Moderate	High	Low.

Table 25.--Classification of the Soils

Soil name	Family or higher taxonomic class
Angelica	Fine-loamy, mixed, active, nonacid, frigid Aeric Endoaquepts
Aquents	Aquents
Au Gres	Sandy, mixed, frigid Typic Endoaquods
Ausable	Sandy, mixed, frigid Histic Humaquepts
Bamfield	Fine-loamy, mixed, active, frigid Haplic Glossudalfs
Blue Lake	Sandy, mixed, frigid Lamellic Haplorthods
Bowstring	Euic, frigid Fluvaquentic Haplosaprists
Caffey	Sandy over loamy, mixed, semiactive, nonacid, frigid Aeric Endoaquents
Cathro	Loamy, mixed, euic, frigid Terric Haplosaprists
Chinwhisker	Sandy, mixed, frigid Lamellic Haplorthods
Croswell	Sandy, mixed, frigid Oxyaquic Haplorthods
Dawson	Sandy or sandy-skeletal, mixed, dysic, frigid Terric Haplosaprists
Deford	Mixed, frigid Typic Psammaquents
East Lake	Sandy, mixed, frigid Entic Haplorthods
Feldhauser	Coarse-loamy, mixed, active, frigid Oxyaquic Glossudalfs
Gladwin	Sandy, mixed, frigid Argic Endoaquods
Glossudalfs	Glossudalfs
Graycalm	Mixed, frigid Lamellic Udipsamments
Grayling	Mixed, frigid Typic Udipsamments
Haplorthods	Haplorthods
Hartwick	Sandy, mixed, frigid Entic Haplorthods
Histosols	Histosols
Islandlake	Sandy, mixed, frigid Lamellic Haplorthods
Kalkaska	Sandy, mixed, frigid Typic Haplorthods
Kellogg	Sandy over clayey, mixed, active, frigid Alfic Oxyaquic Haplorthods
Kent	Fine, mixed, semiactive, frigid Oxyaquic Glossudalfs
Kinross	Sandy, mixed, frigid Typic Endoaquods
Leafriver	Sandy, mixed, frigid Histic Humaquepts
Leelanau	Sandy, mixed, frigid Alfic Haplorthods
Lindquist	Sandy, mixed, frigid Lamellic Haplorthods
Loxley	Dysic, frigid Typic Haplosaprists
Lupton	Euic, frigid Typic Haplosaprists
Mancelona	Sandy, mixed, frigid Alfic Haplorthods
Menominee	Sandy over loamy, mixed, active, frigid Alfic Haplorthods
Millersburg	Coarse-loamy, mixed, active, frigid Haplic Glossudalfs
Morganlake	Sandy over loamy, mixed, active, frigid Alfic Oxyaquic Haplorthods
Mossback	Fine-loamy, mixed, active, frigid Haplic Glossudalfs
Ossineke	Fine-loamy, mixed, semiactive, frigid Oxyaquic Glossudalfs
Rubicon	Sandy, mixed, frigid Entic Haplorthods
Slade	Fine-loamy, mixed, active, frigid Aquic Glossudalfs
Tawas	Sandy or sandy-skeletal, mixed, euic, frigid Terric Haplosaprists
Udipsamments	Udipsamments
Udorthents	Udorthents
Wakeley	Sandy over clayey, mixed, semiactive, nonacid, frigid Aeric Epiaquents

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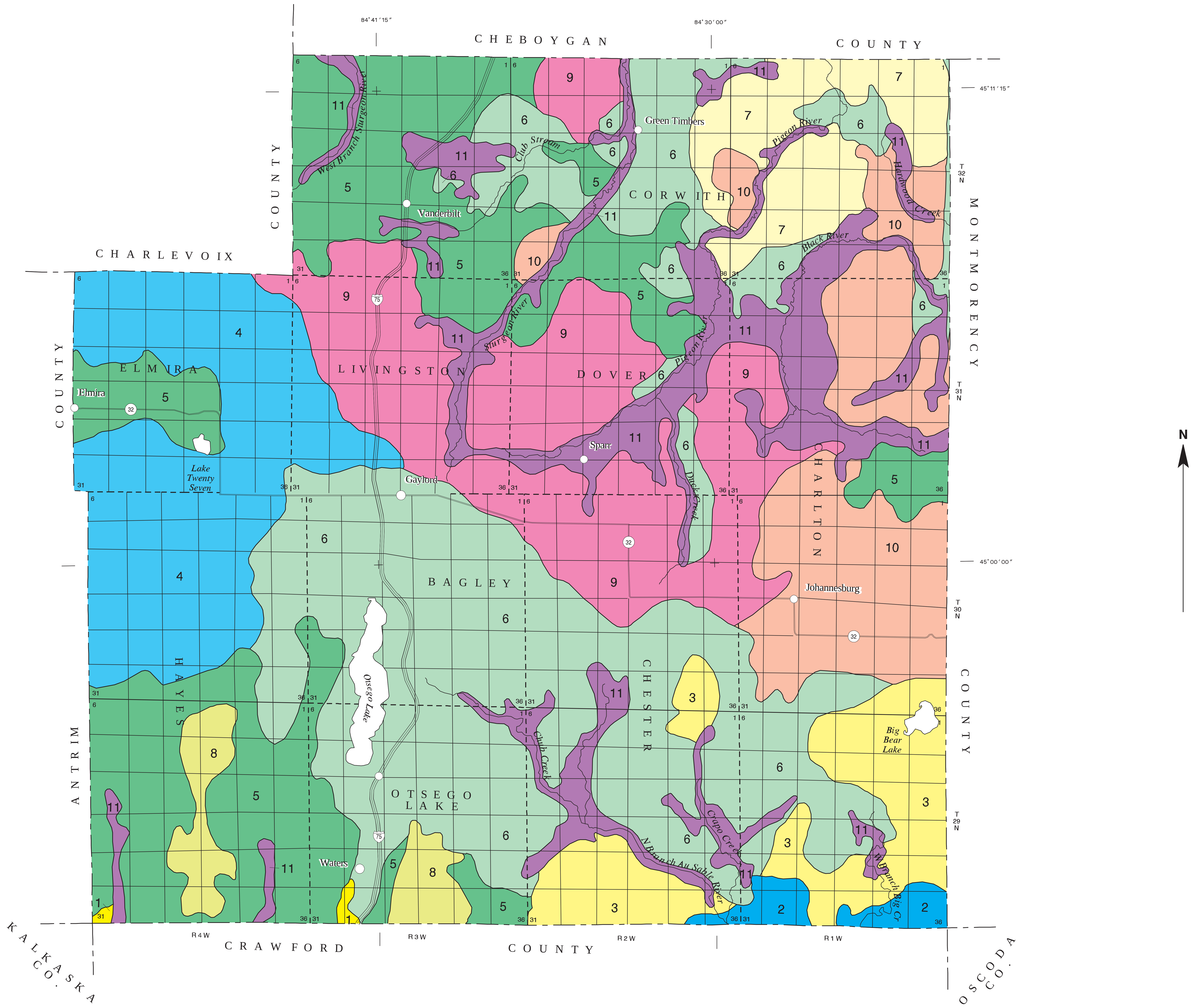


SOIL LEGEND*

1 Rubicon-Croswell Association
2 Grayling Association
3 Graycalm-Grayling Association
4 Islandlake-Blue Lake-Mancelona Association
5 Kalkaska-Blue Lake-Rubicon Association
6 Rubicon-Lindquist Association
7 Leelanau-Lindquist Association
8 Blue Lake-Feldhauser-Kalkaska Association
9 Blue Lake-Mossback-Mancelona Association
10 Ossineke-Blue Lake-Morganlake Association
11 Tawas-Lupton Association

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1998

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN AGRICULTURAL EXPERIMENT STATION
MICHIGAN STATE UNIVERSITY EXTENSION
MICHIGAN TECHNOLOGICAL UNIVERSITY
OTSEGO COUNTY

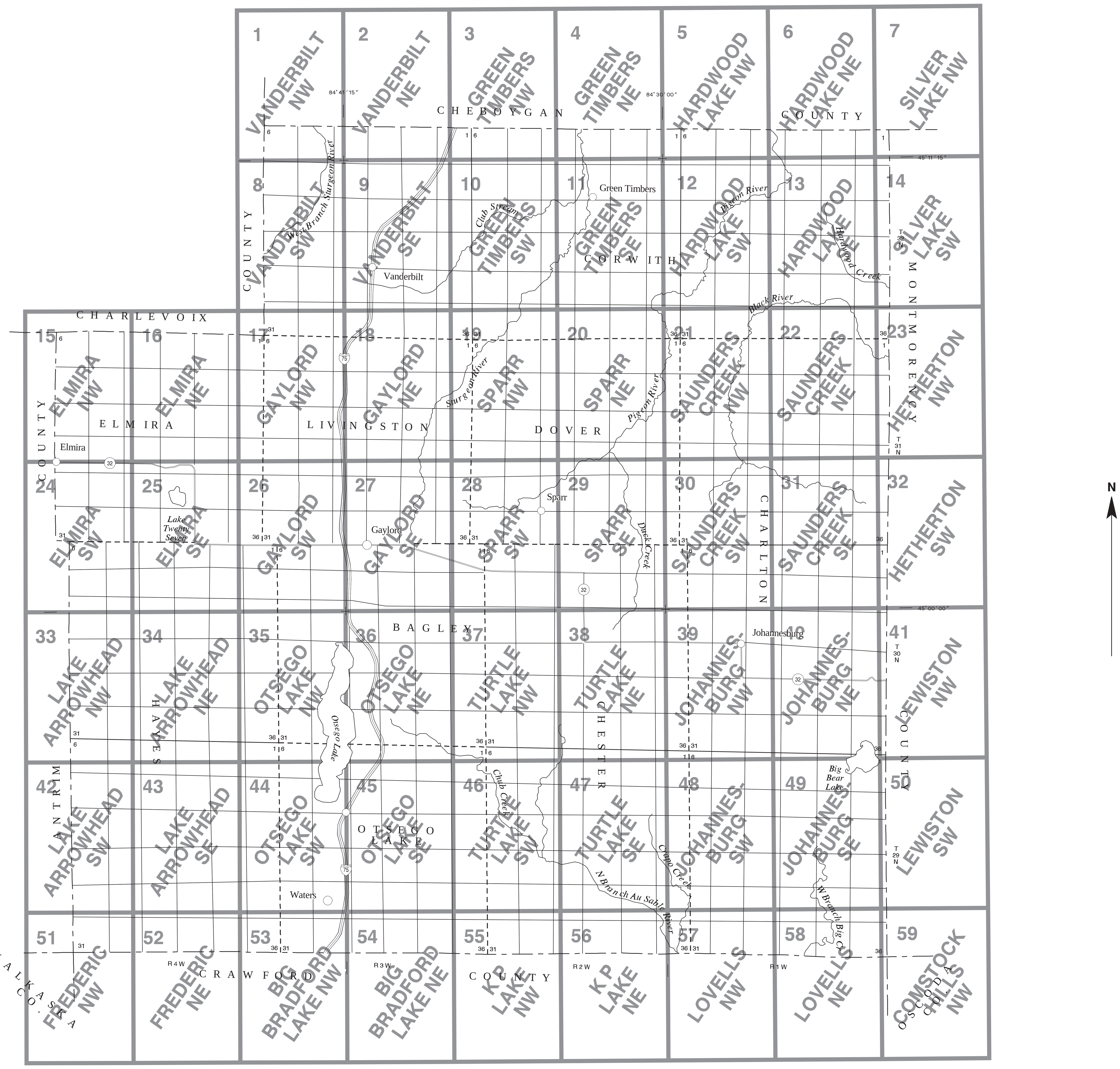
GENERAL SOIL MAP
OTSEGO COUNTY, MICHIGAN

Scale 1:126720

MILES

KILOMETERS

Each area outlined on this map consists of more than one kind of soil. The map is meant for general planning rather than a basis for decisions on the use of specific tracts.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

OTSEGO COUNTY, MICHIGAN

Scale 1:126720

1 0 1 2 3
MILES

1 0 1 2 3 4 5 6
KILOMETERS

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and letters. The initial numbers represent the kind of soil. An uppercase letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or for miscellaneous areas.

SYMBOL	NAME
13	Tawas-Lupton mucks
14	Dawson-Loxley peats
15A	Croswell-Au Gres sands, 0 to 3 percent slopes
16B	Graycalm sand, 0 to 6 percent slopes
17A	Croswell sand, 0 to 3 percent slopes
17B	Croswell sand, 0 to 6 percent slopes
18A	Au Gres sand, 0 to 3 percent slopes
19	Leafriver muck
20B	Graycalm-Grayling sands, 0 to 6 percent slopes
20D	Graycalm-Grayling sands, 6 to 18 percent slopes
20F	Graycalm-Grayling sands, 18 to 45 percent slopes
23	Ausable-Bowstring mucks, frequently flooded
24A	Kinross-Au Gres complex, 0 to 3 percent slopes
25B	Kent sandy loam, 2 to 6 percent slopes
25C	Kent sandy loam, 6 to 12 percent slopes
28B	East Lake sand, 0 to 6 percent slopes
28C	East Lake sand, 6 to 12 percent slopes
28E	East Lake sand, 12 to 35 percent slopes
32B	Kellogg sand, 0 to 6 percent slopes
33B	Mancelona loamy sand, 0 to 6 percent slopes
33C	Mancelona loamy sand, 6 to 12 percent slopes
33D	Mancelona loamy sand, 12 to 18 percent slopes
33E	Mancelona loamy sand, 18 to 35 percent slopes
47D	Graycalm sand, 6 to 18 percent slopes
47F	Graycalm sand, 18 to 45 percent slopes
49B	Kalkaska sand, 0 to 6 percent slopes
50B	Au Gres-Kinross-Croswell complex, 0 to 6 percent slopes
51	Tawas-Leafriver mucks
52B	Blue Lake loamy sand, 0 to 6 percent slopes
52D	Blue Lake loamy sand, 6 to 18 percent slopes
52E	Blue Lake loamy sand, 18 to 35 percent slopes
64B	Feldhauser fine sandy loam, 0 to 6 percent slopes
65F	Rubicon sand, 8 to 50 percent slopes, dissected
75B	Rubicon sand, 0 to 6 percent slopes
75D	Rubicon sand, 6 to 18 percent slopes
75E	Rubicon sand, 18 to 35 percent slopes
78	Pits, borrow
81B	Grayling sand, 0 to 6 percent slopes
81D	Grayling sand, 6 to 18 percent slopes
81E	Grayling sand, 18 to 35 percent slopes
81F	Grayling sand, 18 to 45 percent slopes
82B	Udorthents, loamy, nearly level and undulating
83B	Udipsamments, nearly level and undulating
86	Histosols and Aquents, ponded
90B	Chinwhisker sand, 0 to 4 percent slopes
95D	Menominee loamy sand, 12 to 18 percent slopes
95E	Menominee loamy sand, 18 to 35 percent slopes
113	Angelica loam
115D	Kalkaska sand, 6 to 18 percent slopes
116B	Mancelona sand, 0 to 6 percent slopes
126F	Udipsamments-Haplorthods-Glossudalfs complex, nearly level to steep
127	Cathro muck
141B	Leelanau loamy sand, 0 to 6 percent slopes
141C	Leelanau loamy sand, 6 to 12 percent slopes
141D	Leelanau loamy sand, 12 to 18 percent slopes
146F	Rubicon-Graycalm sands, 8 to 50 percent slopes, dissected
147B	Lindquist sand, 0 to 6 percent slopes
147C	Lindquist sand, 6 to 12 percent slopes
147D	Lindquist sand, 12 to 18 percent slopes
147E	Lindquist sand, 18 to 35 percent slopes
166A	Slade loam, 0 to 3 percent slopes
197A	Gladwin loamy sand, 0 to 3 percent slopes
323B	East Lake-Rubicon sands, 0 to 6 percent slopes
323C	East Lake-Rubicon sands, 6 to 12 percent slopes
337B	Mancelona-East Lake complex, 0 to 6 percent slopes
337C	Mancelona-East Lake complex, 6 to 12 percent slopes
338B	Islandlake sand, 0 to 6 percent slopes
338C	Islandlake sand, 6 to 12 percent slopes
338D	Islandlake sand, 12 to 18 percent slopes
347F	Kalkaska sand, 8 to 50 percent slopes, dissected
349B	Hartwick sand, 0 to 6 percent slopes
350D	Blue Lake sand, 6 to 18 percent slopes
352B	Deford-Au Gres-Croswell complex, 0 to 6 percent slopes
354F	Mancelona-Blue Lake sands, 15 to 70 percent slopes, dissected
360	Wakeley muck
362D	Millersburg loamy sand, 6 to 18 percent slopes
365F	Blue Lake loamy sand, 8 to 50 percent slopes, dissected
368A	Au Gres-Deford complex, 0 to 3 percent slopes
369	Deford muck
380	Access denied
387F	Mancelona-Rubicon sands, 15 to 70 percent slopes, dissected
393B	Morganlake loamy sand, 0 to 6 percent slopes
393C	Morganlake loamy sand, 6 to 12 percent slopes
399D	Menominee-Bamfield, sandy substratum-Blue Lake complex, 12 to 18 percent slopes
400F	Menominee-Bamfield, sandy substratum-Blue Lake complex, 18 to 70 percent slopes, dissected
401F	Lindquist sand, 8 to 50 percent slopes, dissected
402B	Islandlake loamy sand, 0 to 6 percent slopes
402C	Islandlake loamy sand, 6 to 12 percent slopes
402D	Islandlake loamy sand, 12 to 18 percent slopes
424B	Morganlake-Ossineke, sandy substratum-Blue Lake complex, 0 to 6 percent slopes
424C	Morganlake-Ossineke, sandy substratum-Blue Lake complex, 6 to 12 percent slopes
452D	Bamfield fine sandy loam, sandy substratum, 12 to 18 percent slopes
452E	Bamfield fine sandy loam, sandy substratum, 18 to 35 percent slopes
453B	Ossineke fine sandy loam, sandy substratum, 0 to 6 percent slopes
453C	Ossineke fine sandy loam, sandy substratum, 6 to 12 percent slopes
463F	Leelanau loamy sand, 8 to 50 percent slopes, dissected
464B	Mossback sandy loam, 0 to 6 percent slopes
464C	Mossback sandy loam, 6 to 12 percent slopes
464D	Mossback sandy loam, 12 to 18 percent slopes
464E	Mossback sandy loam, 18 to 35 percent slopes
465	Caffey muck
W	Water

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER
(sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE
(normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small
(Named where applicable)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area) (occupied)
- Church
- School
- Indian mound (label)
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial water

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 33E 52D

ESCARPMENTS

- Other than bedrock (points down slope)

SHORT STEEP SLOPE

DEPRESSION, closed

SINKHOLE

MISCELLANEOUS

- Clay spot
- Gravelly spot
- Sandy spot
- Severely eroded spot
- Stony spot
- Loam at depth
- Bog
- Mineral spot
- Cut and fill spot
- Dump
- Gravel strata
- Loamy spot
- Organic spot
- Marl

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
VANDERBILT NW QUADRANGLE
SHEET NUMBER 1 OF 59

SCALE 1:12000

MILES

FEET

KILOMETERS

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 EPSILON SE (CHARLEVOIX COUNTY)
2 WILDWOOD SW (CHEBOYGAN COUNTY)
3 WILDWOOD SE (CHEBOYGAN COUNTY)
4 THUMB LAKE NE (CHARLEVOIX COUNTY)
5 VANDERBILT NE (SHEET 2)
6 THUMB LAKE SE (CHARLEVOIX COUNTY)
7 VANDERBILT SW (SHEET 8)
8 VANDERBILT SE (SHEET 9)

INDEX TO ADJOINING 3.75 MAPS

VANDERBILT NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 1 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
VANDERBILT NE QUADRANGLE
SHEET NUMBER 2 OF 59

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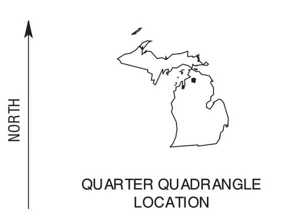

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5 MILES

500 0 500 1000 1500 2000 2500 3000 3500 FEET

0.5 0 0.5 KILOMETERS

1	2	3
4		5
6	7	8

1 WILDWOOD SW (CHEBOYGAN COUNTY)
2 WILDWOOD SE (CHEBOYGAN COUNTY)
3 WOLVERINE SW (CHEBOYGAN COUNTY)
4 VANDERBILT NW (SHEET 1)
5 GREEN TIMBERS NW (SHEET 3)
6 VANDERBILT SW (SHEET 8)
7 VANDERBILT SE (SHEET 9)
8 GREEN TIMBERS SW (SHEET 10)

INDEX TO ADJOINING 3.75 MAPS

VANDERBILT NE, MICHIGAN
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SHEET NUMBER 2 OF 59

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UNITED STATES
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NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
GREEN TIMBERS NW QUADRANGLE
SHEET NUMBER 3 OF 59

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

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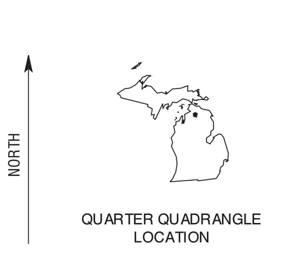

QUARTER QUADRANGLE
LOCATION

1	2	3
4		5
6	7	8

1 WILDWOOD SE (CHEBOYGAN COUNTY)
2 WOLVERINE SW (CHEBOYGAN COUNTY)
3 WOLVERINE SE (CHEBOYGAN COUNTY)
4 VANDERBILT NE (SHEET 2)
5 GREEN TIMBERS NE (SHEET 4)
6 VANDERBILT SE (SHEET 9)
7 GREEN TIMBERS SW (SHEET 10)
8 GREEN TIMBERS SE (SHEET 11)

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GREEN TIMBERS NW, MICHIGAN
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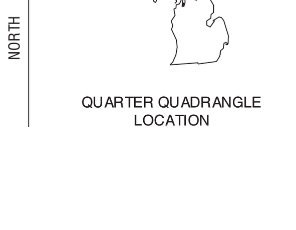

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 WOLVERINE SW (CHEBOYGAN COUNTY)
2 WOLVERINE SE (CHEBOYGAN COUNTY)
3 AFTON SW (CHEBOYGAN COUNTY)
4 GREEN TIMBERS NW (SHEET 3)
5 HARDWOOD LAKE NW (SHEET 5)
6 GREEN TIMBERS SW (SHEET 10)
7 GREEN TIMBERS SE (SHEET 11)
8 HARDWOOD LAKE SW (SHEET 12)

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3.75 MINUTE SERIES
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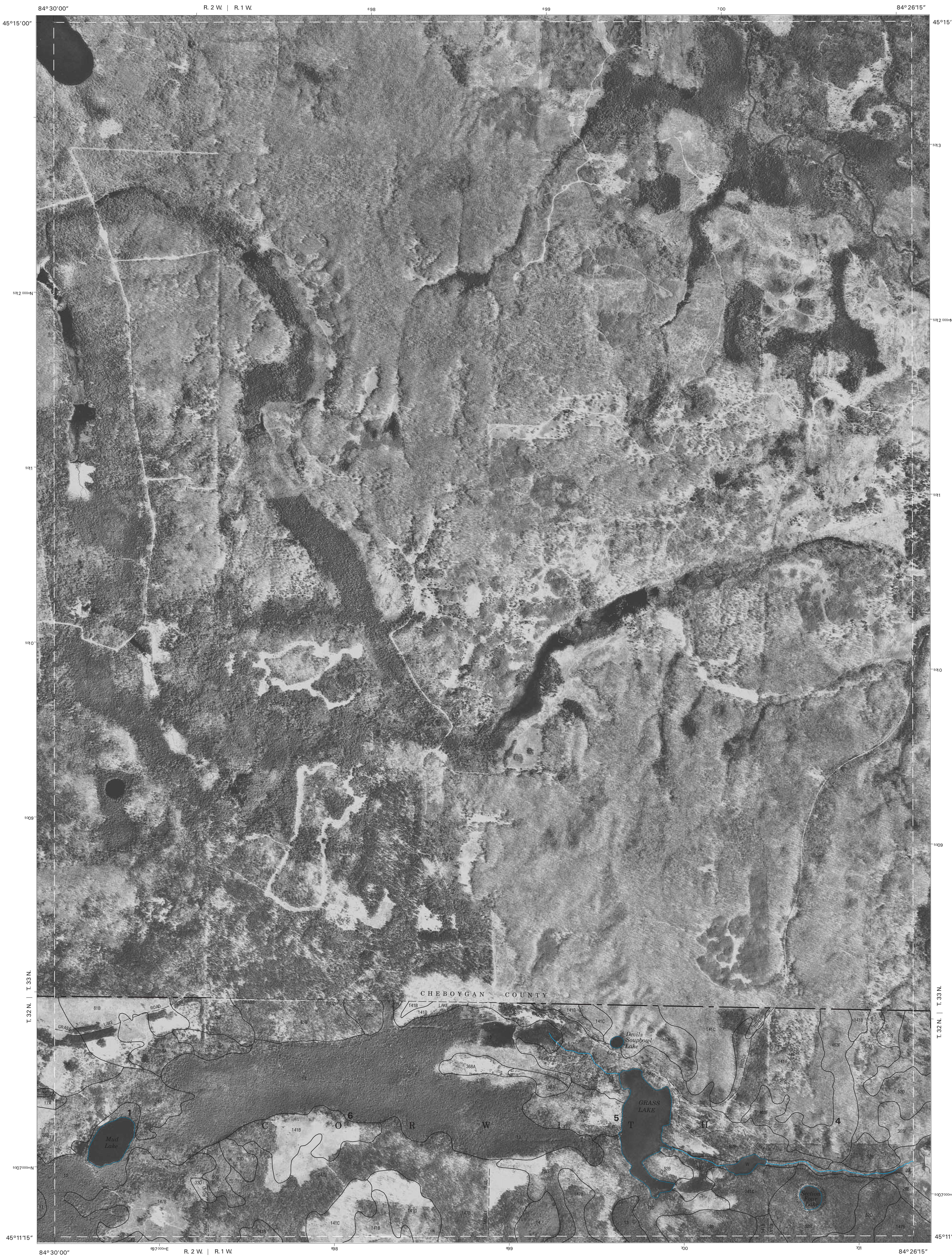
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
HARDWOOD LAKE NW QUADRANGLE
SHEET NUMBER 5 OF 59



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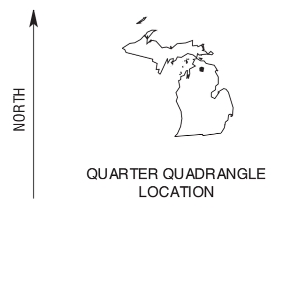

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES · FEET · KILOMETERS

1	2	3
4		5
6	7	8

1 WOLVERINE SE (CHEBOYGAN CO.)
2 AFTON SW (CHEBOYGAN COUNTY)
3 AFTON SE (CHEBOYGAN COUNTY)
4 GREEN TIMBERS NE (SHEET 4)
5 HARDWOOD LAKE NE (SHEET 6)
6 GREEN TIMBERS SE (SHEET 11)
7 HARDWOOD LAKE SW (SHEET 12)
8 HARDWOOD LAKE SE (SHEET 13)

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HARDWOOD LAKE NW, MICHIGAN
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SHEET NUMBER 5 OF 59

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NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
HARDWOOD LAKE NE QUADRANGLE
SHEET NUMBER 6 OF 59

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5
FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500
KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 AFTON SW (CHEBOYGAN COUNTY)
2 AFTON SE (CHEBOYGAN COUNTY)
3 TOWER SW (CHEBOYGAN COUNTY)
4 HARDWOOD LAKE NW (SHEET 5)
5 SILVER LAKE NW (SHEET 7)
6 HARDWOOD LAKE SW (SHEET 12)
7 HARDWOOD LAKE SE (SHEET 13)
8 SILVER LAKE SW (SHEET 14)

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HARDWOOD LAKE NE, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 6 OF 59

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NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
SILVER LAKE NW QUADRANGLE
SHEET NUMBER 7 OF 59

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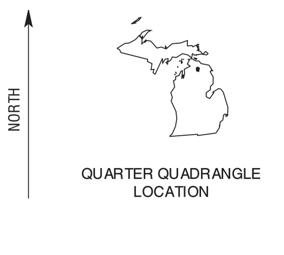
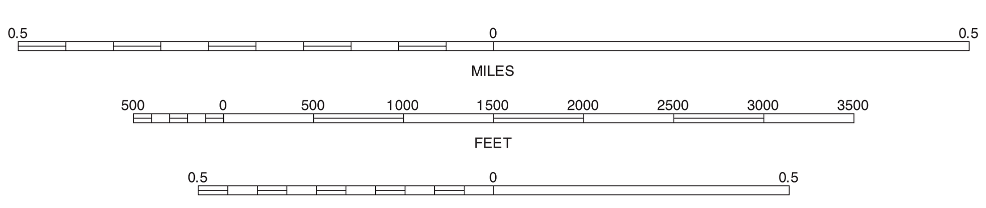


QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1. AFTON SE (CHEBOYGAN COUNTY)
2. TOWER SW (CHEBOYGAN COUNTY)
3. TOWER SE (CHEBOYGAN COUNTY)
4. HARDWOOD LAKE NE (SHEET 6)
5. SILVER LAKE NE (MONTMORENCY COUNTY)
6. HARDWOOD LAKE SE (SHEET 13)
7. SILVER LAKE SW (SHEET 14)
8. SILVER LAKE SE (MONTMORENCY COUNTY)

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SILVER LAKE NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 7 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

84° 45′ 00″ R. 4 W. | R. 3 W. 84° 41′15″

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES 0.5 0 0.5

FEET 500 0 500 1000 1500 2000 2500 3000 3500

KILOMETERS 0.5 0 0.5

1	2	3
4		5
6	7	8

1 THUMB LAKE NE (CHARLEVOIX COUNTY)
2 VANDERBILT NW (SHEET 1)
3 VANDERBILT NE (SHEET 2)
4 THUMB LAKE SE (CHARLEVOIX COUNTY)
5 VANDERBILT SE (SHEET 9)
6 ELMIRA NE (SHEET 16)
7 GAYLORD NW (SHEET 17)
8 GAYLORD NE (SHEET 18)

INDEX TO ADJOINING 3.75 MAPS

VANDERBILT SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 8 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

84° 41′15″ — 682000mE — 683 — R. 3 W. — 684 — 685 — 686 — 84° 37′30″

45°11′15″ — 45°11′15″

45° 07′30″ — 45° 07′30″

84° 41′15″ — 682000mE — 683 — R. 3 W. — 684 — 685 — 686 — 84° 37′30″

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 — 0 — 0.5
MILES

500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500
FEET

0.5 — 0 — 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 VANDERBILT NW (SHEET 1)
2 VANDERBILT NE (SHEET 2)
3 GREEN TIMBERS NW (SHEET 3)
4 VANDERBILT SW (SHEET 8)
5 GREEN TIMBERS SW (SHEET 10)
6 GAYLORD NW (SHEET 17)
7 GAYLORD NE (SHEET 18)
8 SPARR NW (SHEET 19)

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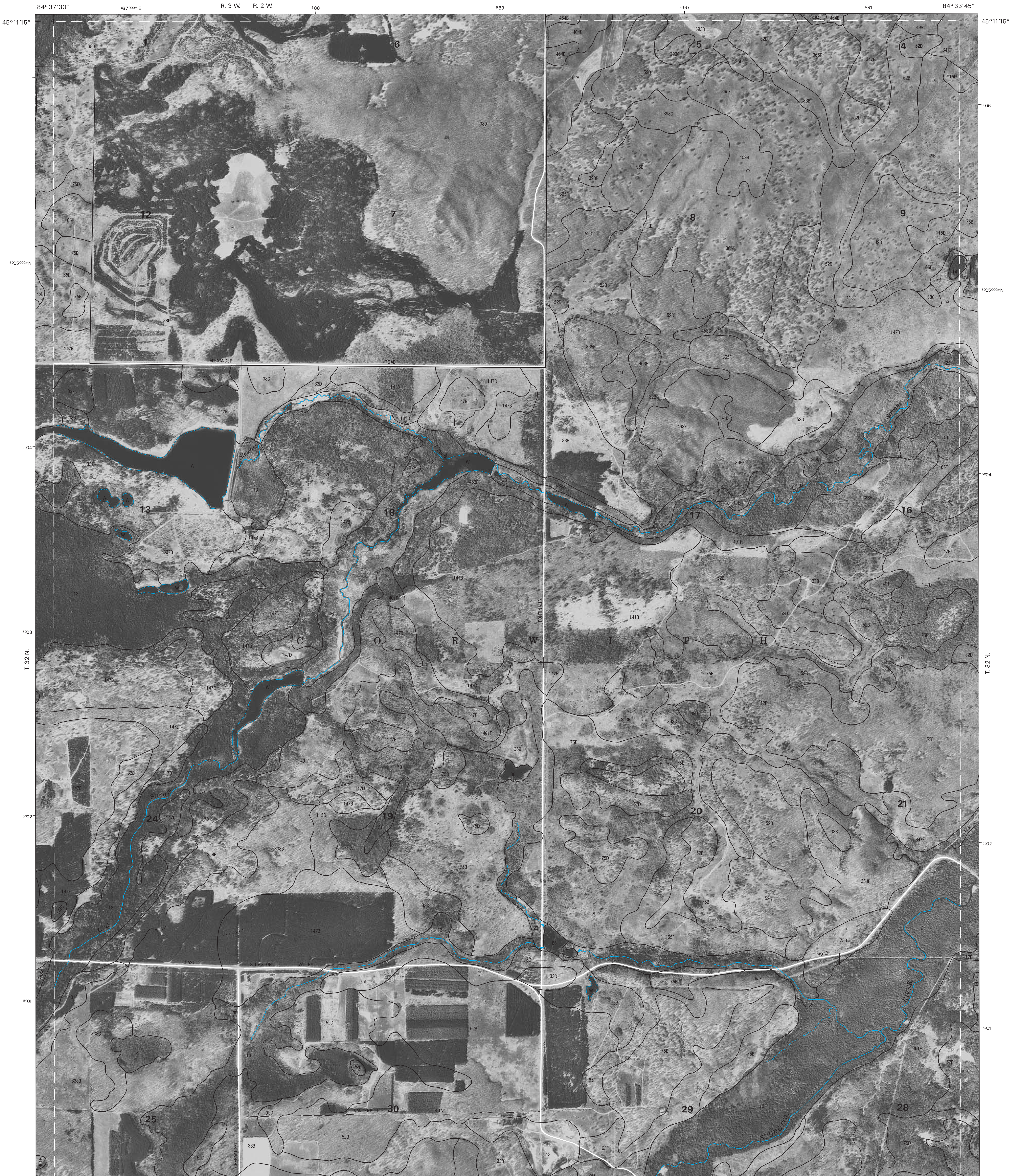
VANDERBILT SE, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 9 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
GREEN TIMBERS SW QUADRANGLE
SHEET NUMBER 10 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 VANDERBILT NE (SHEET 2)
2 GREEN TIMBERS NW (SHEET 3)
3 GREEN TIMBERS NE (SHEET 4)
4 VANDERBILT SE (SHEET 9)
5 GREEN TIMBERS SE (SHEET 11)
6 GAYLORD NE (SHEET 18)
7 SPARR NW (SHEET 19)
8 SPARR NE (SHEET 20)

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GREEN TIMBERS SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 10 OF 59

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 16.
Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 GREEN TIMBERS NW (SHEET 3)
2 GREEN TIMBERS NE (SHEET 4)
3 HARDWOOD LAKE NW (SHEET 5)
4 GREEN TIMBERS SW (SHEET 10)
5 HARDWOOD LAKE SW (SHEET 12)
6 SPARR NW (SHEET 19)
7 SPARR NE (SHEET 20)
8 SAUNDERS CREEK NW (SHEET 21)

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GREEN TIMBERS SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 11 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
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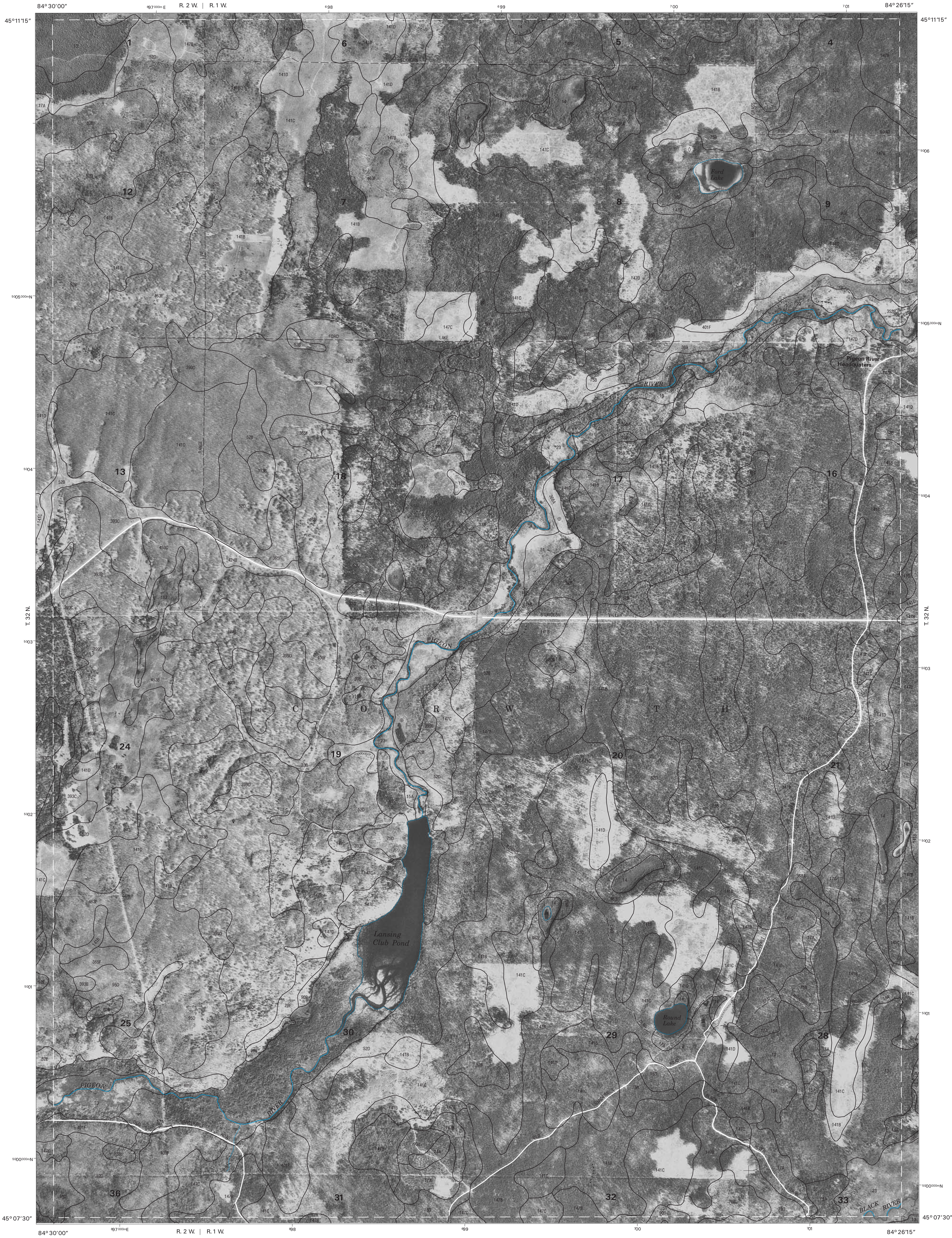

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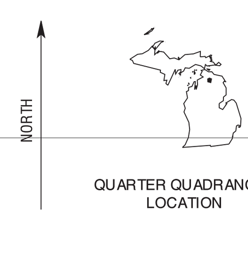
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



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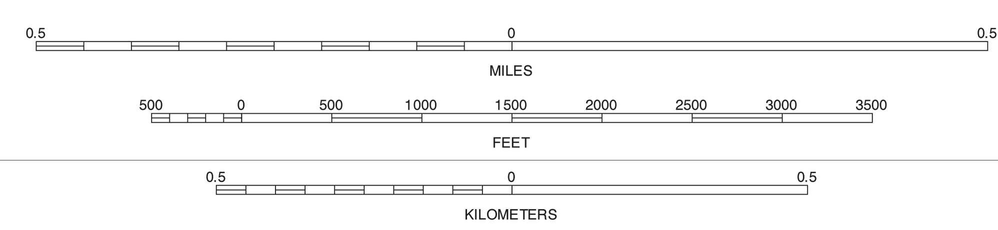

1	2	3
4		5
6	7	8

1 GREEN TIMBERS NE (SHEET 4)
2 HARDWOOD LAKE NW (SHEET 5)
3 HARDWOOD LAKE NE (SHEET 6)
4 GREEN TIMBERS SE (SHEET 11)
5 HARDWOOD LAKE SE (SHEET 13)
6 SPARR NE (SHEET 20)
7 SAUNDERS CREEK NW (SHEET 21)
8 SAUNDERS CREEK NE (SHEET 22)

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HARDWOOD LAKE SW, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 12 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
HARDWOOD LAKE SE QUADRANGLE
SHEET NUMBER 13 OF 59

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 0 0.5

FEET: 500 0 500 1000 1500 2000 2500 3000 3500

KILOMETERS: 0.5 0 0.5

1 HARDWOOD LAKE NW (SHEET 5)
2 HARDWOOD LAKE NE (SHEET 6)
3 SILVER LAKE NW (SHEET 7)
4 HARDWOOD LAKE SW (SHEET 12)
5 SILVER LAKE SW (SHEET 14)
6 SAUNDERS CREEK NW (SHEET 21)
7 SAUNDERS CREEK NE (SHEET 22)
8 HETHERTON NW (SHEET 23)

INDEX TO ADJOINING 3.75 MAPS

HARDWOOD LAKE SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 13 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

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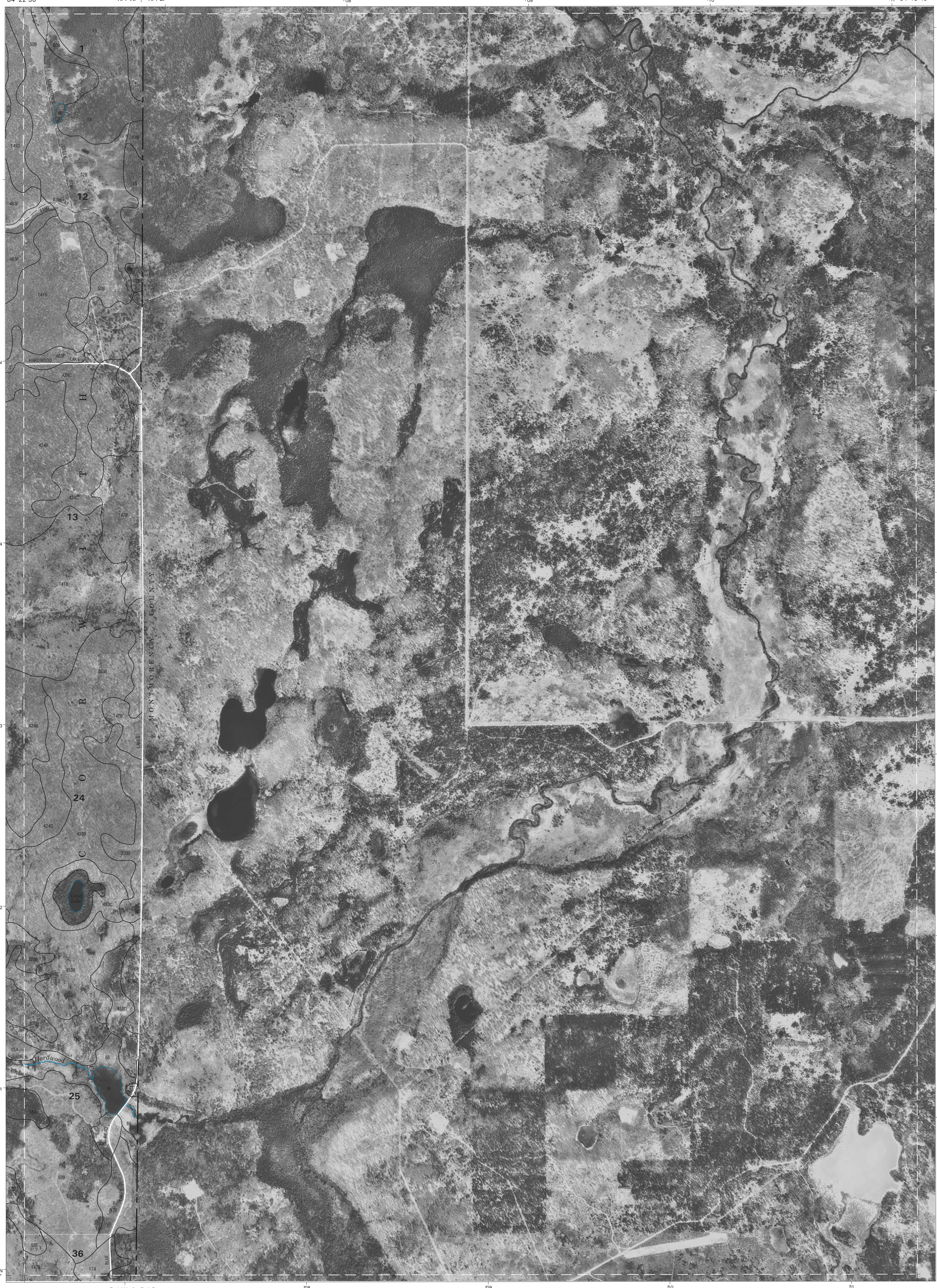
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

84° 22′30″ R. 1 W. | R. 1 E. 708 709 710 711 84°18′45″

45°11′15″ 45°11′15″



45° 07′30″ 45° 07′30″

84° 22′30″ R. 1 W. | R. 1 E. 708 709 710 711 84°18′45″

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 HARDWOOD LAKE NE (SHEET 6)
2 SILVER LAKE NW (SHEET 7)
3 SILVER LAKE NE (MONTMORENCY COUNTY)
4 HARDWOOD LAKE SE (SHEET 13)
5 SILVER LAKE SE (MONTMORENCY COUNTY)
6 SAUNDERS CREEK NE (SHEET 22)
7 HETHERTON NW (SHEET 23)
8 HETHERTON NE (MONTMORENCY COUNTY)

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SILVER LAKE SW, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 14 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
ELMIRA NW QUADRANGLE
SHEET NUMBER 15 OF 59

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 BOYNE FALLS SE (CHARLEVOIX COUNTY)
2 THUMB LAKE SW (CHARLEVOIX COUNTY)
3 THUMB LAKE SE (CHARLEVOIX COUNTY)
4 DEADMANS HILL NW (ANTRIM COUNTY)
5 ELMIRA NE (SHEET 16)
6 DEADMANS HILL SE (ANTRIM COUNTY)
7 ELMIRA SW (SHEET 24)
8 ELMIRA SE (SHEET 25)

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ELMIRA NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 15 OF 59

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OTSEGO COUNTY, MICHIGAN
ELMIRA NE QUADRANGLE
SHEET NUMBER 16 OF 59

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5 MILES

500 0 500 1000 1500 2000 2500 3000 3500 FEET

0.5 0 0.5 KILOMETERS

1	2	3
4		5
6	7	8

1 THUMB LAKE SW (CHARLEVOIX COUNTY)
2 THUMB LAKE SE (CHARLEVOIX COUNTY)
3 VANDERBILT SW (SHEET 8)
4 ELMIRA NW (SHEET 15)
5 GAYLORD NW (SHEET 17)
6 ELMIRA SW (SHEET 24)
7 ELMIRA SE (SHEET 25)
8 GAYLORD SW (SHEET 26)

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ELMIRA NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 16 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

84° 45′00″ R. 4 W. | R. 3 W. 84° 41′15″

45° 07′30″ 45° 07′30″

45° 03′45″ 45° 03′45″

84° 45′00″ 678000mE R. 4 W. | R. 3 W. 679 680 681 84° 41′15″

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 THUMB LAKE SE (CHARLEVOIX COUNTY)
2 VANDERBILT SW (SHEET 8)
3 VANDERBILT SE (SHEET 9)
4 ELMIRA NE (SHEET 16)
5 GAYLORD NE (SHEET 18)
6 ELMIRA SE (SHEET 25)
7 GAYLORD SW (SHEET 26)
8 GAYLORD SE (SHEET 27)

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GAYLORD NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 17 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
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OTSEGO COUNTY, MICHIGAN
GAYLORD NE QUADRANGLE
SHEET NUMBER 18 OF 59

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3	
4		5	
6	7	8	

1 VANDERBILT SW (SHEET 8)
2 VANDERBILT SE (SHEET 9)
3 GREEN TIMBERS SW (SHEET 10)
4 GAYLORD NW (SHEET 17)
5 SPARR NW (SHEET 19)
6 GAYLORD SW (SHEET 26)
7 GAYLORD SE (SHEET 27)
8 SPARR SW (SHEET 28)

INDEX TO ADJOINING 3.75 MAPS

GAYLORD NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 18 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

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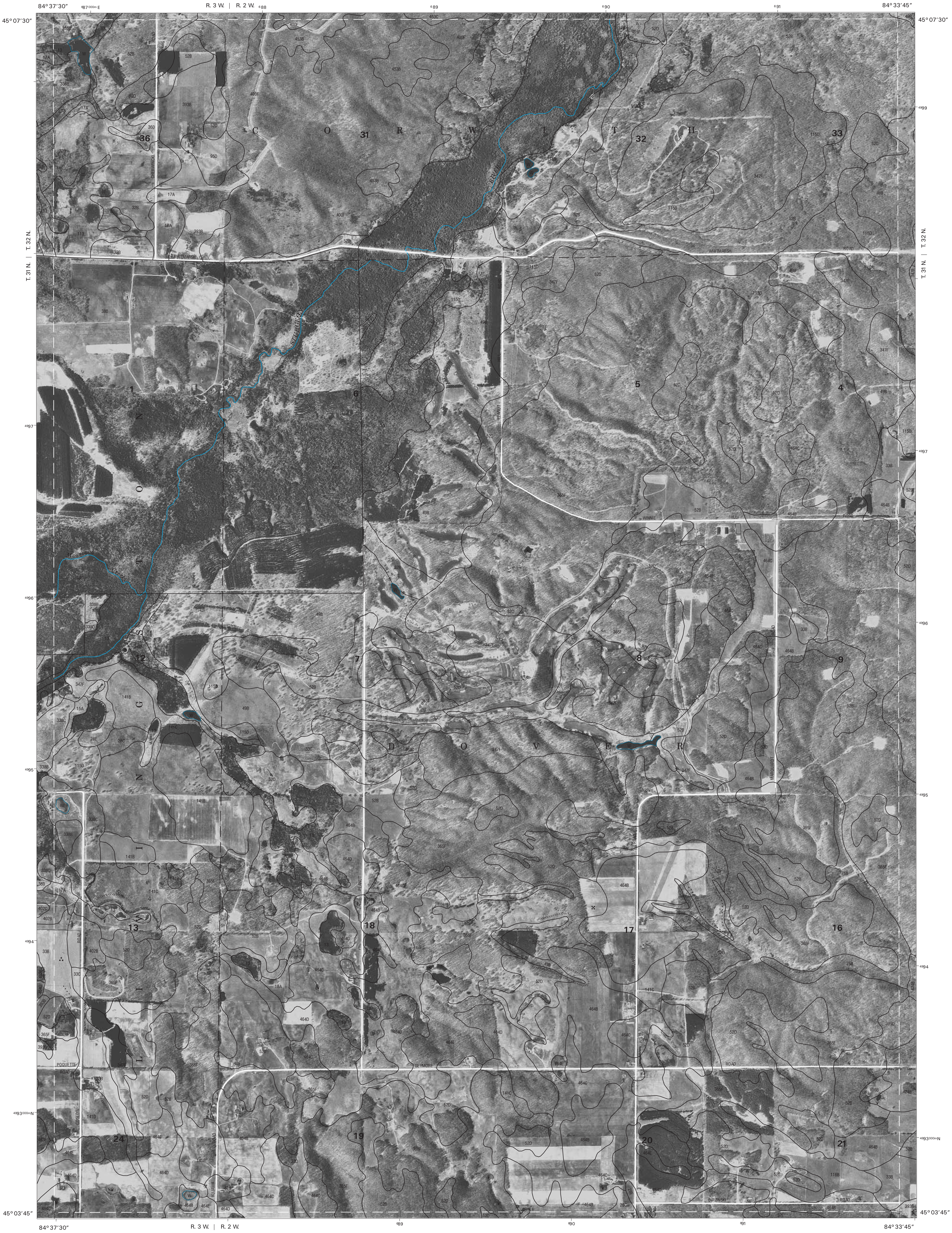
OTSEGO COUNTY, MICHIGAN
SPARR NW QUADRANGLE
SHEET NUMBER 19 OF 59



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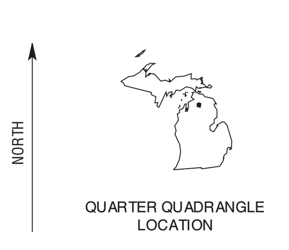
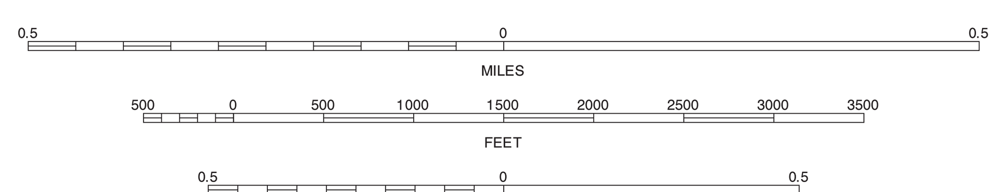
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 VANDERBILT SE (SHEET 9)
2 GREEN TIMBERS SW (SHEET 10)
3 GREEN TIMBERS SE (SHEET 11)
4 GAYLORD NE (SHEET 18)
5 SPARR NE (SHEET 20)
6 GAYLORD SE (SHEET 27)
7 SPARR SW (SHEET 28)
8 SPARR SE (SHEET 29)

INDEX TO ADJOINING 3.75 MAPS

SPARR NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 19 OF 59

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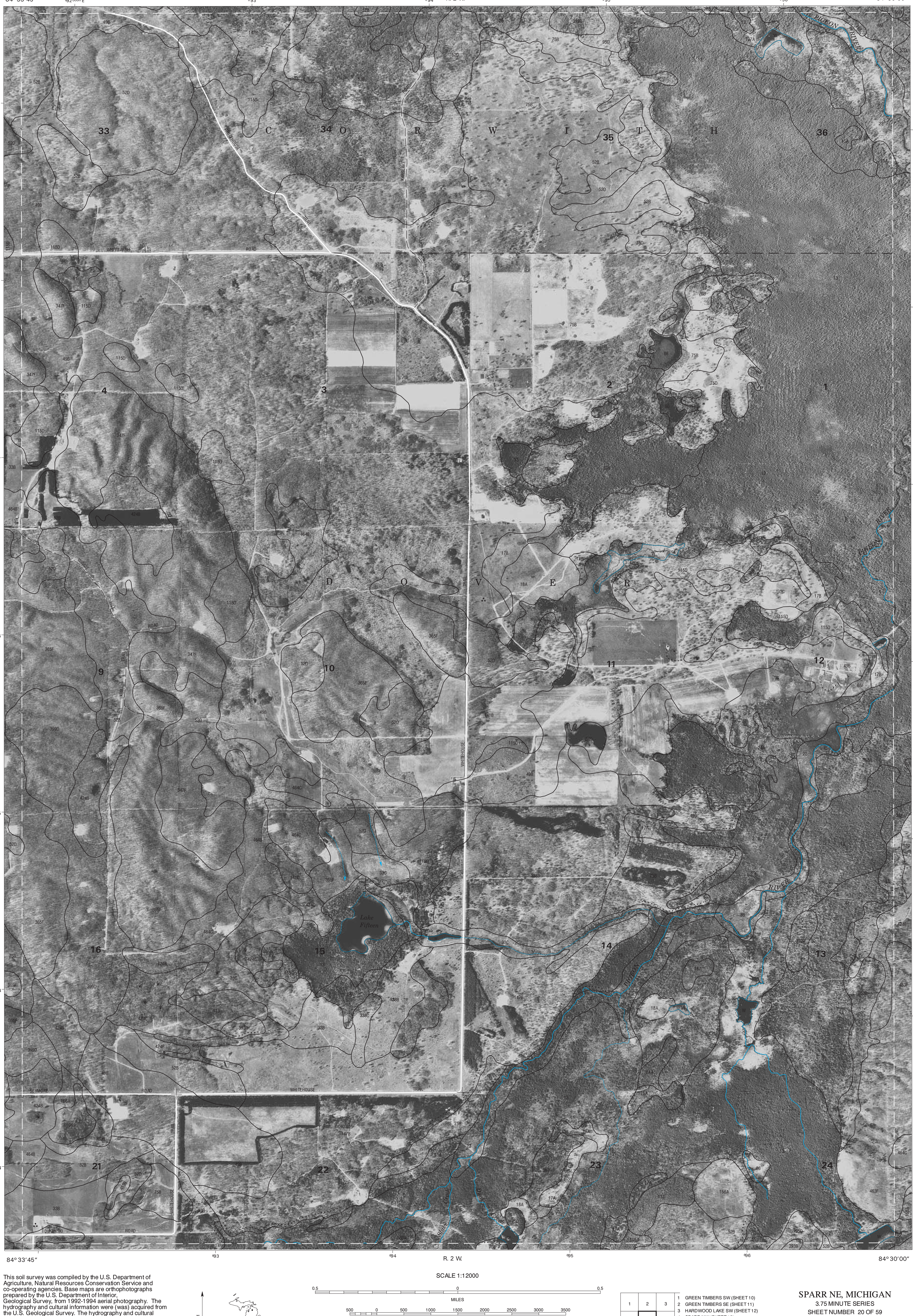
OTSEGO COUNTY, MICHIGAN
SPARR NE QUADRANGLE
SHEET NUMBER 20 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

INDEX TO ADJOINING 3.75 MAPS

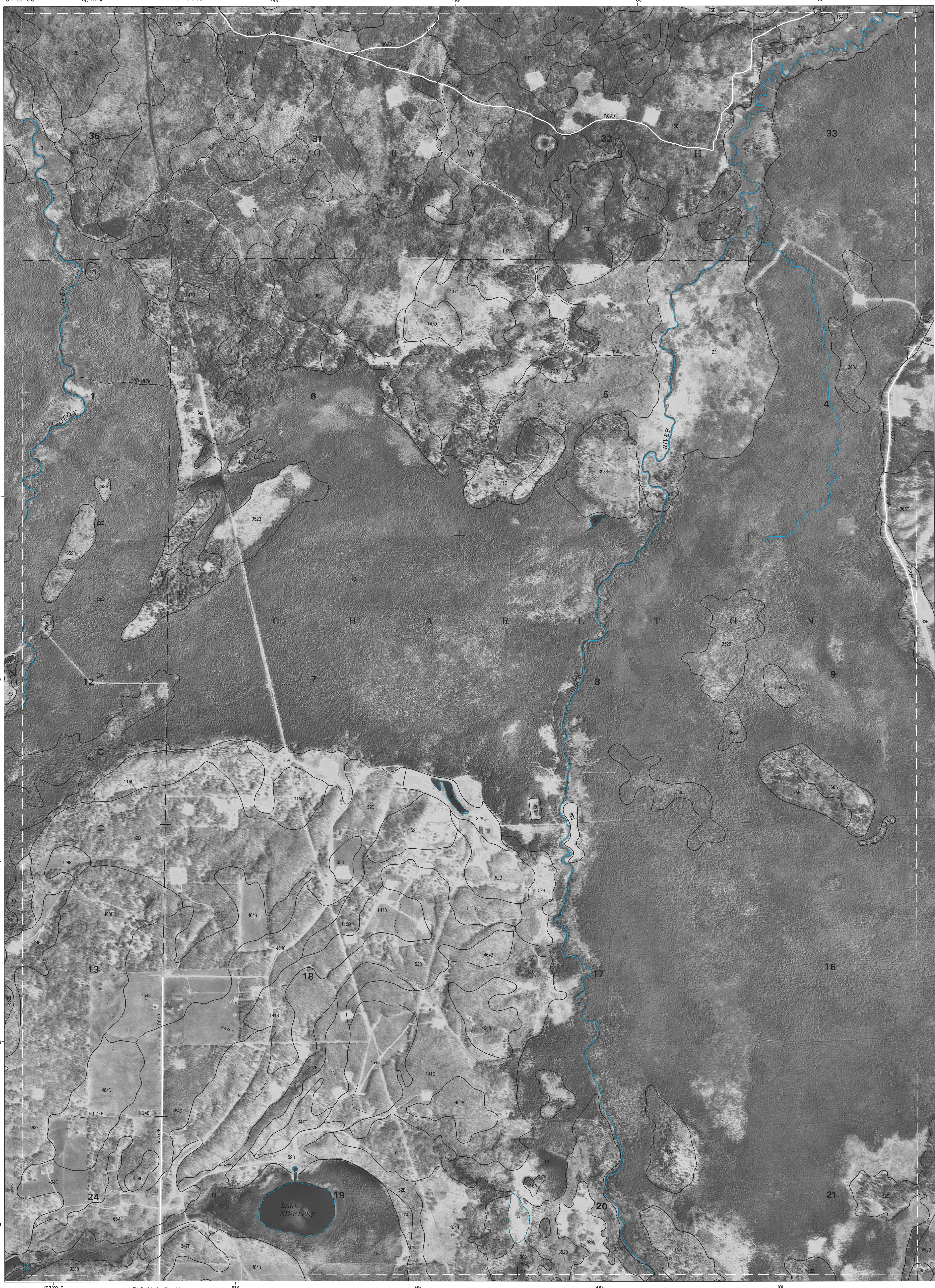
1 GREEN TIMBERS SW (SHEET 10)
2 GREEN TIMBERS SE (SHEET 11)
3 HARDWOOD LAKE SW (SHEET 12)
4 SPARR NW (SHEET 19)
5 SAUNDERS CREEK NW (SHEET 21)
6 SPARR SW (SHEET 28)
7 SPARR SE (SHEET 29)
8 SAUNDERS CREEK SW (SHEET 30)

SPARR NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 20 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
SAUNDERS CREEK NW QUADRANGLE
SHEET NUMBER 21 OF 59



SCALE 1:12000

MILES

FEET

KILOMETERS

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

1 GREEN TIMBERS SE (SHEET 11)
2 HARDWOOD LAKE SW (SHEET 12)
3 HARDWOOD LAKE SE (SHEET 13)
4 SPARR NE (SHEET 20)
5 SAUNDERS CREEK NE (SHEET 22)
6 SPARR SE (SHEET 29)
7 SAUNDERS CREEK SW (SHEET 30)
8 SAUNDERS CREEK SE (SHEET 31)

INDEX TO ADJOINING 3.75 MAPS

SAUNDERS CREEK NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 21 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
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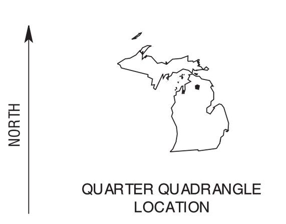
OTSEGO COUNTY, MICHIGAN
SAUNDERS CREEK NE QUADRANGLE
SHEET NUMBER 22 OF 59

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



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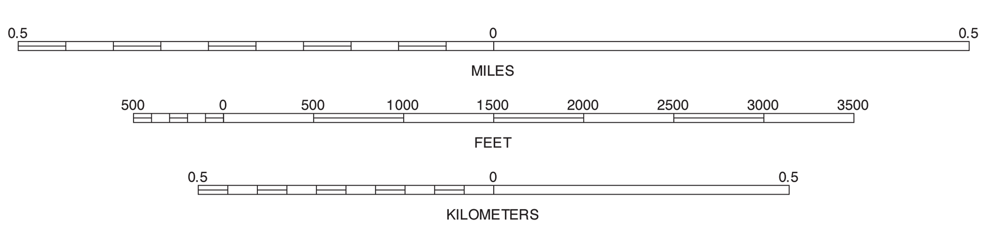

1	2	3
4		5
6	7	8

1 HARDWOOD LAKE SW (SHEET 12)
2 HARDWOOD LAKE SE (SHEET 13)
3 SILVER LAKE SW (SHEET 14)
4 SAUNDERS CREEK NW (SHEET 21)
5 HETHERTON NW (SHEET 23)
6 SAUNDERS CREEK SW (SHEET 30)
7 SAUNDERS CREEK SE (SHEET 31)
8 HETHERTON SW (SHEET 32)

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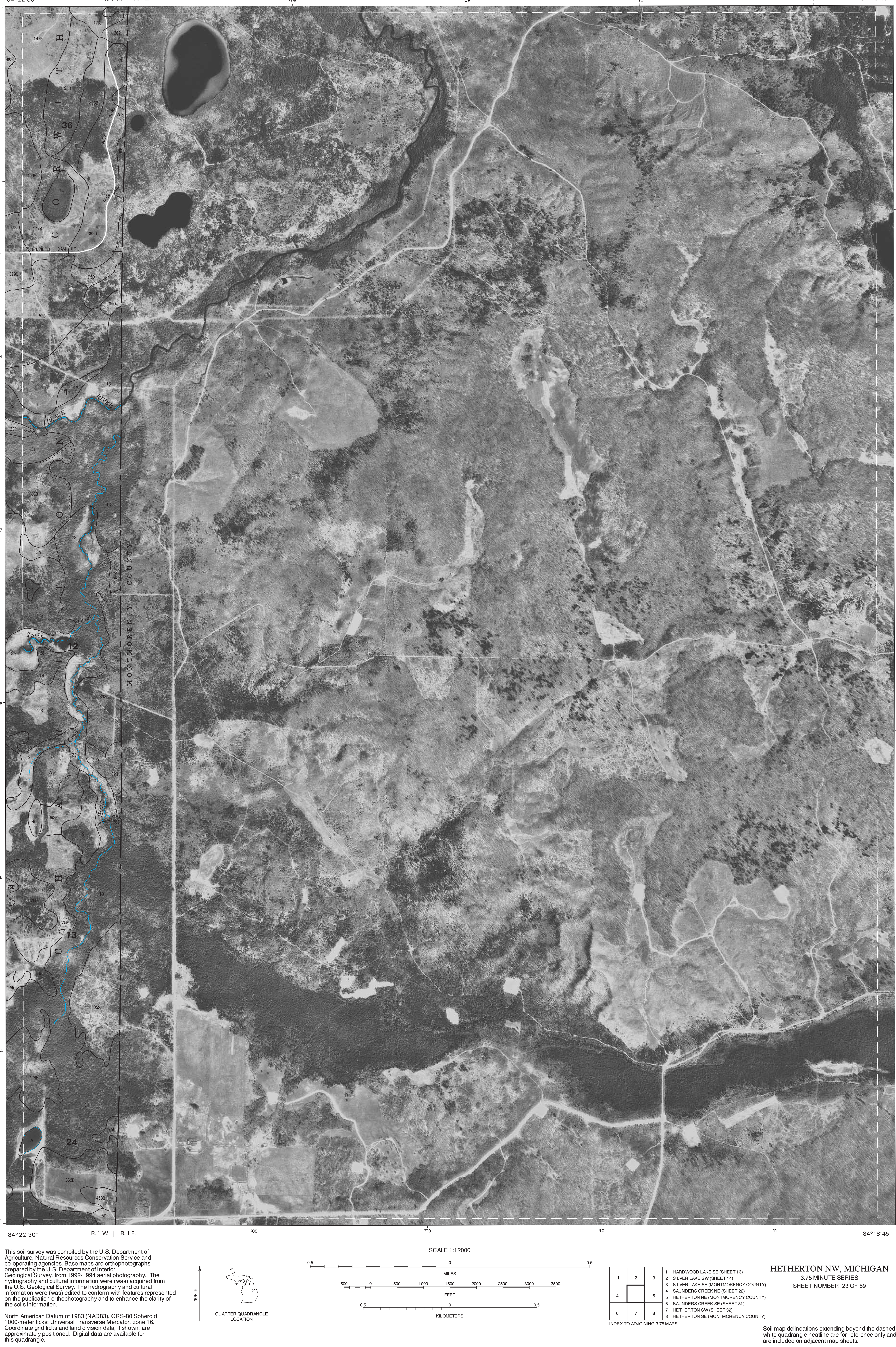
SAUNDERS CREEK NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 22 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

1	2	3
4		5
6	7	8

1 HARDWOOD LAKE SE (SHEET 13)
2 SILVER LAKE SW (SHEET 14)
3 SILVER LAKE SE (MONTMORENCY COUNTY)
4 SAUNDERS CREEK NE (SHEET 22)
5 HETHERTON NE (MONTMORENCY COUNTY)
6 SAUNDERS CREEK SE (SHEET 31)
7 HETHERTON SW (SHEET 32)
8 HETHERTON SE (MONTMORENCY COUNTY)

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HETHERTON NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 23 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
ELMIRA SW QUADRANGLE
SHEET NUMBER 24 OF 59

84° 52′30″ | 668000mE | R. 5 W. | R. 4 W. | 669 | 670 | 671 | 672 | 84° 48′45″

45° 03′45″

T. 30 N. | T. 31 N.

45° 00′00″

84° 52′30″ | 668000mE | 669 | R. 5 W. | R. 4 W. | 670 | 671 | 672 | 84° 48′45″

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 16.
Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 | 0 | 0.5 MILES

500 | 0 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500 FEET

0.5 | 0 | 0.5 KILOMETERS

1	2	3
4		5
6	7	8

1 DEADMANS HILL NW (ANTRIM COUNTY)
2 ELMIRA NW (SHEET 15)
3 ELMIRA NE (SHEET 16)
4 DEADMANS HILL SE (ANTRIM COUNTY)
5 ELMIRA SE (SHEET 25)
6 ALBA NE (ANTRIM COUNTY)
7 LAKE ARROWHEAD NW (SHEET 33)
8 LAKE ARROWHEAD NE (SHEET 34)

INDEX TO ADJOINING 3.75 MAPS

ELMIRA SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 24 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 16.
Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 ELMIRA NW (SHEET 15)
2 ELMIRA NE (SHEET 16)
3 GAYLORD NW (SHEET 17)
4 ELMIRA SW (SHEET 24)
5 GAYLORD SW (SHEET 26)
6 LAKE ARROWHEAD NW (SHEET 33)
7 LAKE ARROWHEAD NE (SHEET 34)
8 OTSEGO LAKE NW (SHEET 35)

INDEX TO ADJOINING 3.75 MAPS

ELMIRA SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 25 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
GAYLORD SW QUADRANGLE
SHEET NUMBER 26 OF 59

84° 45′00″ | R. 4 W. | R. 3 W. | 84° 41′15″
45° 03′45″

45° 00′00″
84° 45′00″ | $^{6}78^{000m}E$ | R. 4 W. | R. 3 W. | $^{6}80$ | $^{6}81$ | $^{6}82$ | 84° 41′15″

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 | 0 | 0.5
MILES

500 | 0 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500
FEET

0.5 | 0 | 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 ELMIRA NE (SHEET 16)
2 GAYLORD NW (SHEET 17)
3 GAYLORD NE (SHEET 18)
4 ELMIRA SE (SHEET 25)
5 GAYLORD SE (SHEET 27)
6 LAKE ARROWHEAD NE (SHEET 34)
7 OTSEGO LAKE NW (SHEET 35)
8 OTSEGO LAKE NE (SHEET 36)

INDEX TO ADJOINING 3.75 MAPS

GAYLORD SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 26 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
GAYLORD SE QUADRANGLE
SHEET NUMBER 27 OF 59

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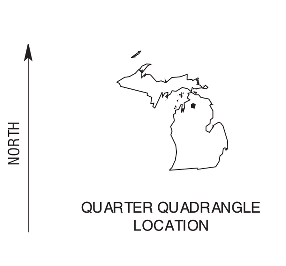

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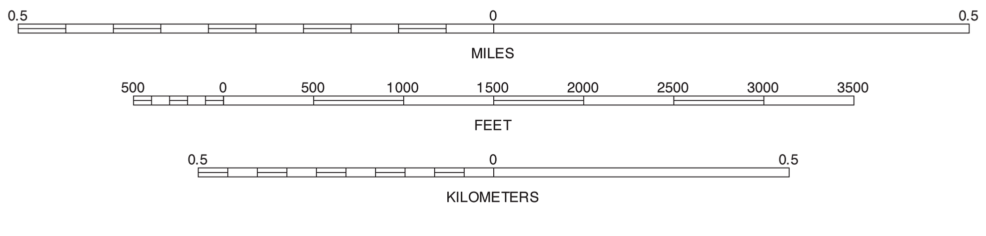

1	2	3
4		5
6	7	8

1 GAYLORD NW (SHEET 17)
2 GAYLORD NE (SHEET 18)
3 SPARR NW (SHEET 19)
4 GAYLORD SW (SHEET 26)
5 SPARR SW (SHEET 28)
6 OTSEGO LAKE NW (SHEET 35)
7 OTSEGO LAKE NE (SHEET 36)
8 TURTLE LAKE NW (SHEET 37)

INDEX TO ADJOINING 3.75 MAPS

GAYLORD SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 27 OF 59

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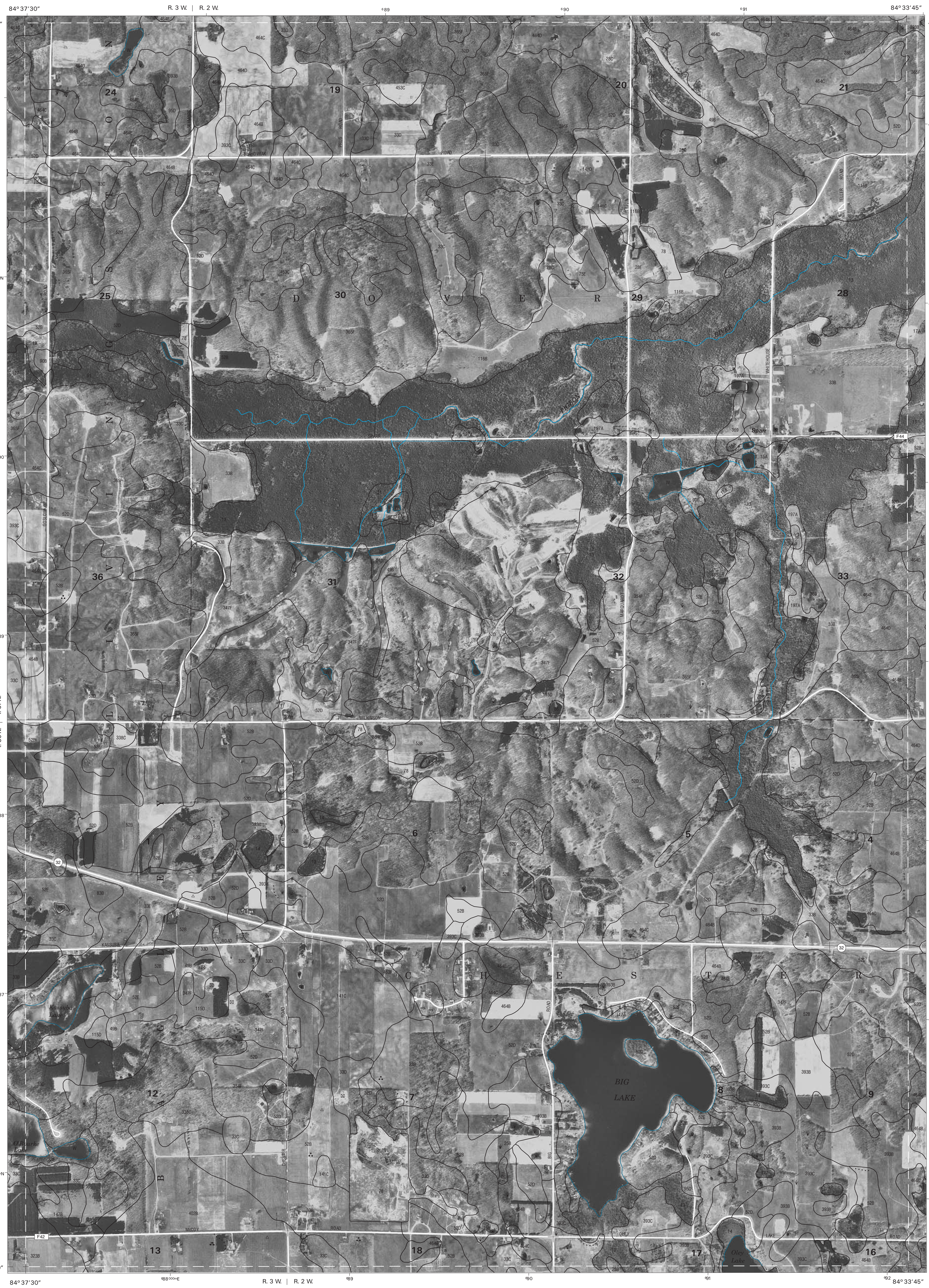
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
SPARR SW QUADRANGLE
SHEET NUMBER 28 OF 59



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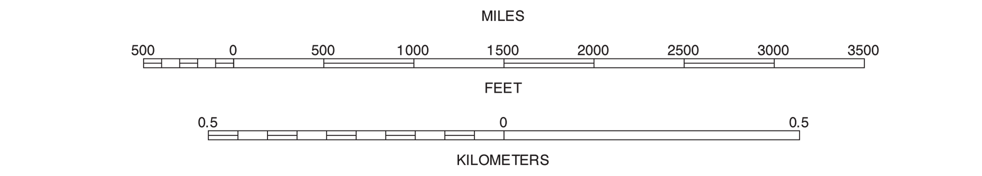
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3	
4		5	
6	7	8	

1 GAYLORD NE (SHEET 18)
2 SPARR NW (SHEET 19)
3 SPARR NE (SHEET 20)
4 GAYLORD SE (SHEET 27)
5 SPARR SE (SHEET 29)
6 OTSEGO LAKE NE (SHEET 36)
7 TURTLE LAKE NW (SHEET 37)
8 TURTLE LAKE NE (SHEET 38)

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SPARR SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 28 OF 59

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UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
SPARR SE QUADRANGLE
SHEET NUMBER 29 OF 59

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 SPARR NW (SHEET 19)
2 SPARR NE (SHEET 20)
3 SAUNDERS CREEK NW (SHEET 21)
4 SPARR SW (SHEET 28)
5 SAUNDERS CREEK SW (SHEET 30)
6 TURTLE LAKE NW (SHEET 37)
7 TURTLE LAKE NE (SHEET 38)
8 JOHANNESBURG NW (SHEET 39)

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SPARR SE, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 29 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
SAUNDERS CREEK SW QUADRANGLE
SHEET NUMBER 30 OF 59

84° 30′00″ R. 2 W. | R. 1 W. 84° 26′15″

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3	
4		5	
6	7	8	

1 SPARR NE (SHEET 20)
2 SAUNDERS CREEK NW (SHEET 21)
3 SAUNDERS CREEK NE (SHEET 22)
4 SPARR SE (SHEET 29)
5 SAUNDERS CREEK SE (SHEET 31)
6 TURTLE LAKE NE (SHEET 38)
7 JOHANNESBURG NW (SHEET 39)
8 JOHANNESBURG NE (SHEET 40)

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SAUNDERS CREEK SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 30 OF 59

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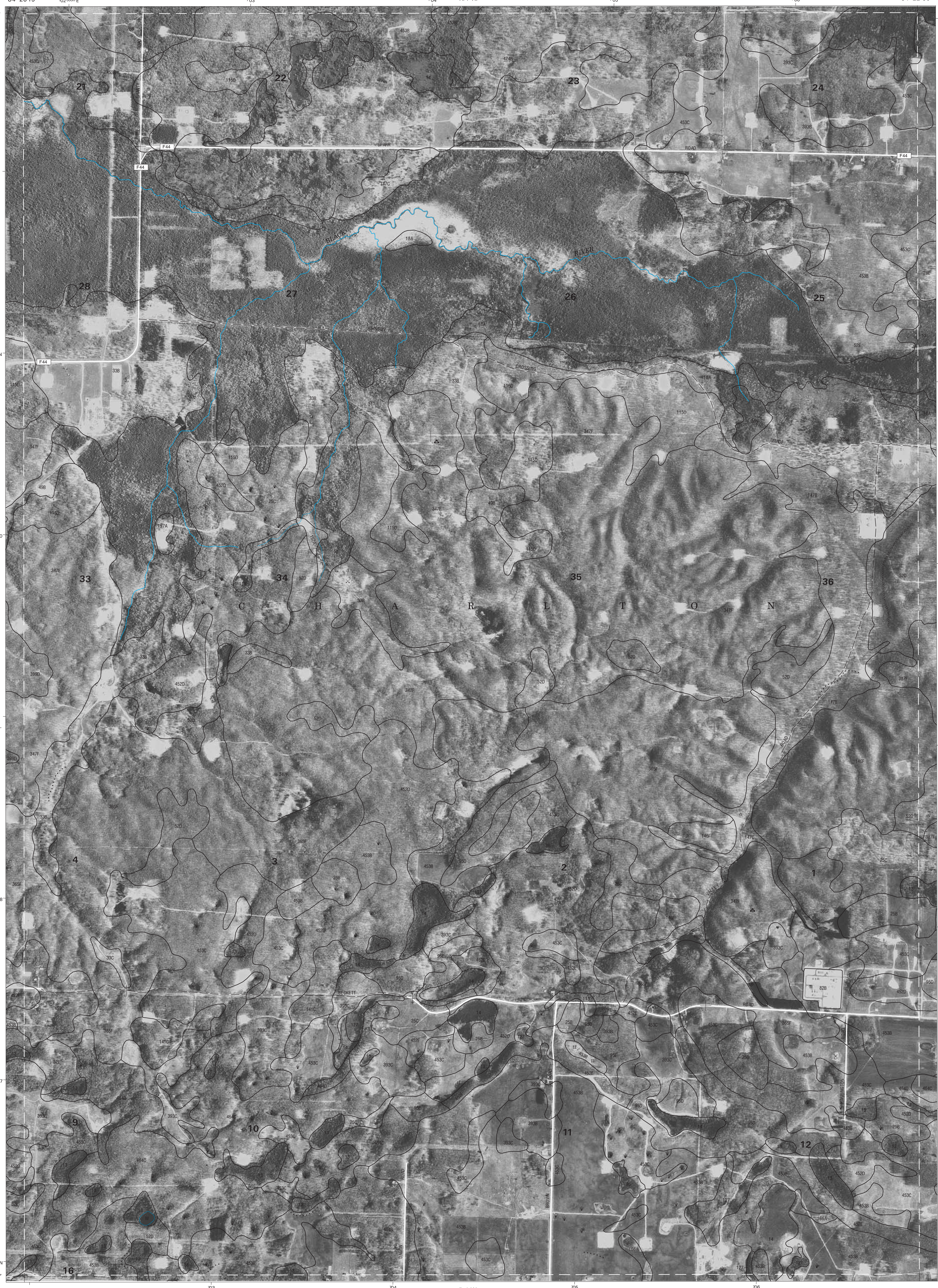
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
SAUNDERS CREEK SE QUADRANGLE
SHEET NUMBER 31 OF 59



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 SAUNDERS CREEK NW (SHEET 21)
2 SAUNDERS CREEK NE (SHEET 22)
3 HETHERTON NW (SHEET 23)
4 SAUNDERS CREEK SW (SHEET 30)
5 HETHERTON SW (SHEET 32)
6 JOHANNESBURG NW (SHEET 39)
7 JOHANNESBURG NE (SHEET 40)
8 LEWISTON NW (SHEET 41)

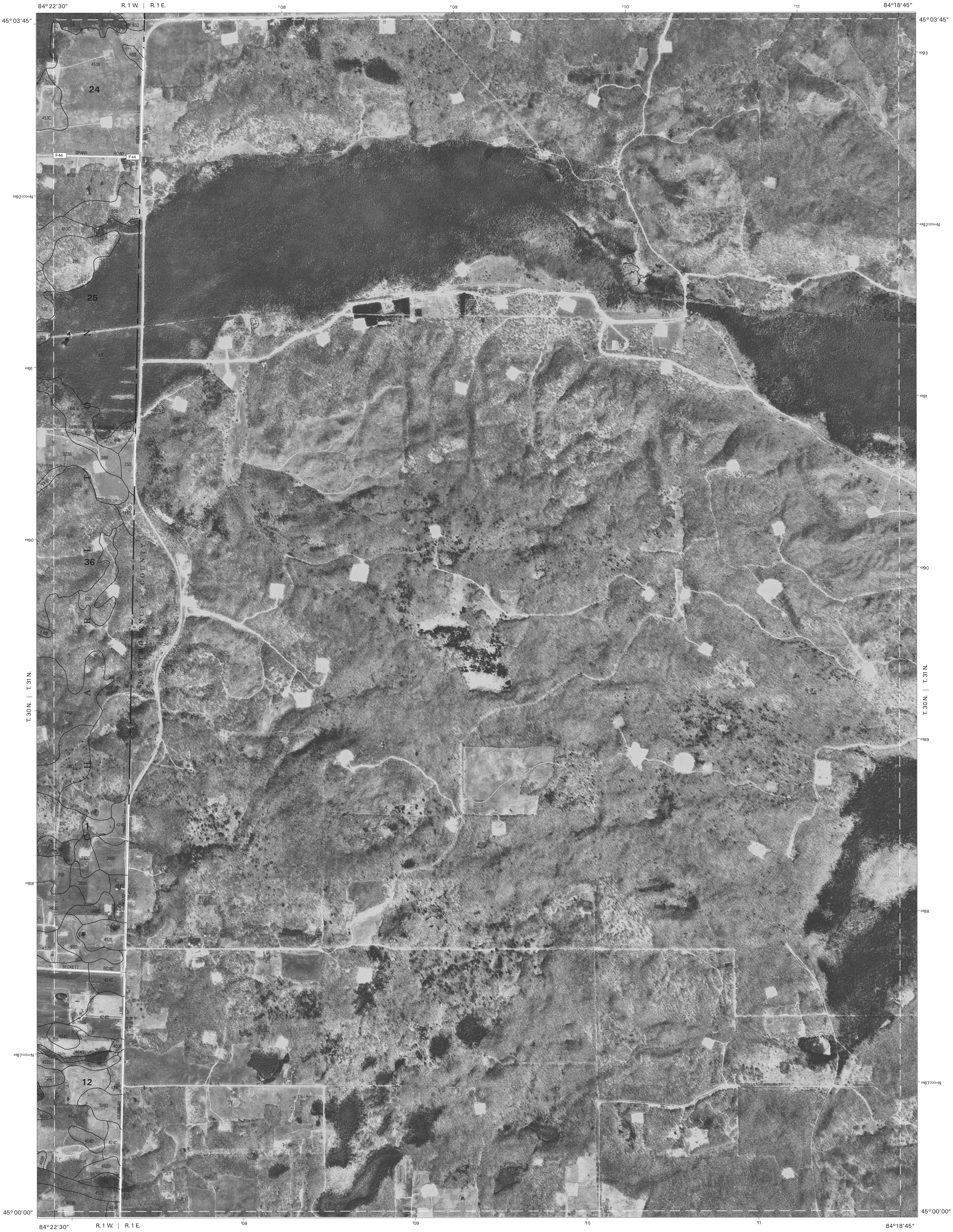
INDEX TO ADJOINING 3.75 MAPS

SAUNDERS CREEK SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 31 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
HETHERTON SW QUADRANGLE
SHEET NUMBER 32 OF 59



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1000-meter ticks: Universal Transverse Mercator, zone 16.
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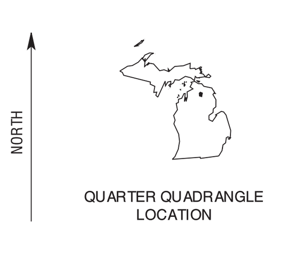

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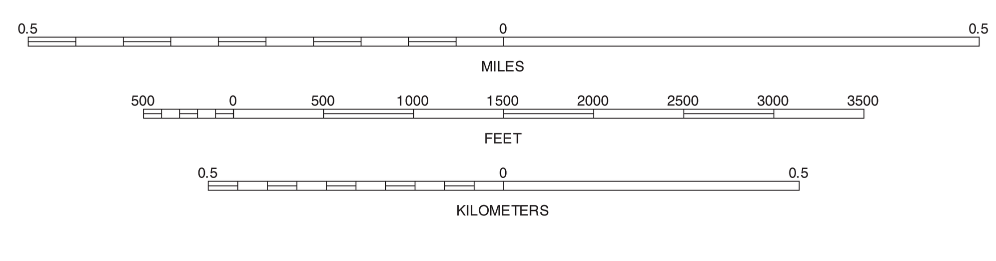

1	2	3
4		5
6	7	8

1 SAUNDERS CREEK NE (SHEET 22)
2 HETHERTON NW (SHEET 23)
3 HETHERTON NE (MONTMORENCY COUNTY)
4 SAUNDERS CREEK SE (SHEET 31)
5 HETHERTON SE (MONTMORENCY COUNTY)
6 JOHANNESBURG NE (SHEET 40)
7 LEWISTON NW (SHEET 41)
8 LEWISTON NE (MONTMORENCY COUNTY)

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HETHERTON SW, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 32 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
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NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
LAKE ARROWHEAD NW QUADRANGLE
SHEET NUMBER 33 OF 59

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 DEADMANS HILL SE (ANTRIM COUNTY)
2 ELMIRA SW (SHEET 24)
3 ELMIRA SE (SHEET 25)
4 ALBA NE (ANTRIM COUNTY)
5 LAKE ARROWHEAD NE (SHEET 34)
6 ALBA SE (ANTRIM COUNTY)
7 LAKE ARROWHEAD SW (SHEET 42)
8 LAKE ARROWHEAD SE (SHEET 43)

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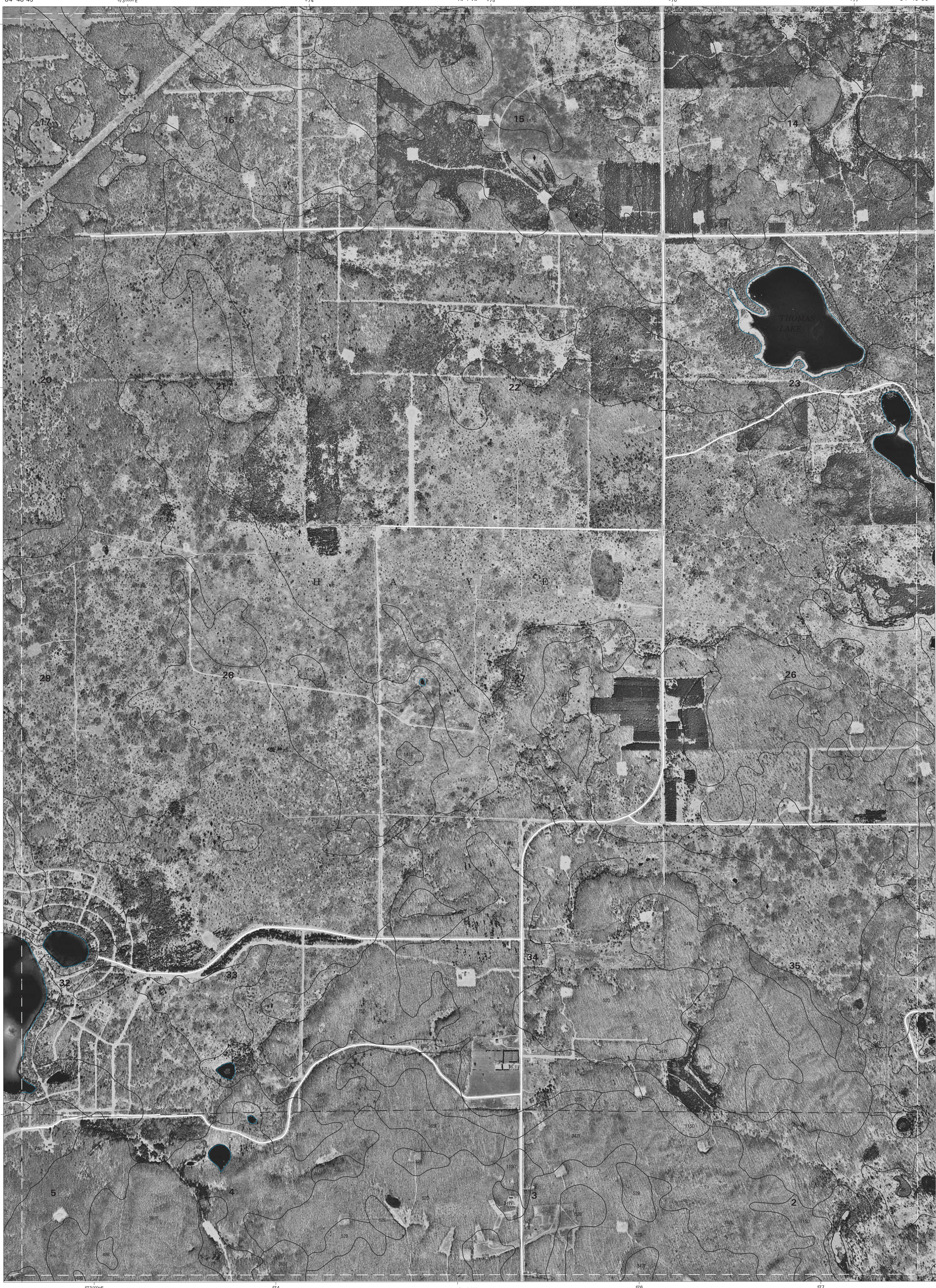
LAKE ARROWHEAD NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 33 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
LAKE ARROWHEAD NE QUADRANGLE
SHEET NUMBER 34 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 ELMIRA SW (SHEET 24)
2 ELMIRA SE (SHEET 25)
3 GAYLORD SW (SHEET 26)
4 LAKE ARROWHEAD NW (SHEET 33)
5 OTSEGO LAKE NW (SHEET 35)
6 LAKE ARROWHEAD SW (SHEET 42)
7 LAKE ARROWHEAD SE (SHEET 43)
8 OTSEGO LAKE SW (SHEET 44)

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LAKE ARROWHEAD NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 34 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
OTSEGO LAKE NW QUADRANGLE
SHEET NUMBER 35 OF 59

84° 45′00″ | R. 4 W. | R. 3 W. | 84° 41′15″
45° 00′00″

44° 56′15″
84° 45′00″ | R. 4 W. | R. 3 W. | 84° 41′15″

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 16.
Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 — 0 — 0.5 MILES

500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500 FEET

0.5 — 0 — 0.5 KILOMETERS

1	2	3	
4		5	
6	7	8	

1 ELMIRA SE (SHEET 25)
2 GAYLORD SW (SHEET 26)
3 GAYLORD SE (SHEET 27)
4 LAKE ARROWHEAD NE (SHEET 34)
5 OTSEGO LAKE NE (SHEET 36)
6 LAKE ARROWHEAD SE (SHEET 43)
7 OTSEGO LAKE SW (SHEET 44)
8 OTSEGO LAKE SE (SHEET 45)

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OTSEGO LAKE NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 35 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

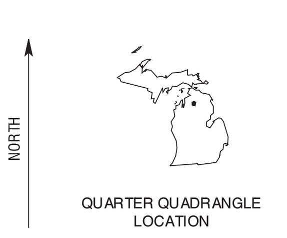
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
OTSEGO LAKE NE QUADRANGLE
SHEET NUMBER 36 OF 59

84° 41′15″ R. 3 W. 84° 37′30″

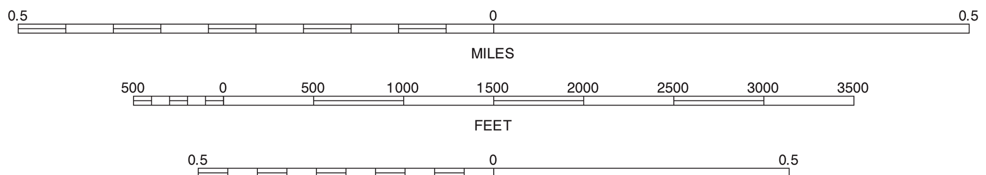
This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 GAYLORD SW (SHEET 26)
2 GAYLORD SE (SHEET 27)
3 SPARR SW (SHEET 28)
4 OTSEGO LAKE NW (SHEET 35)
5 TURTLE LAKE NW (SHEET 37)
6 OTSEGO LAKE SW (SHEET 44)
7 OTSEGO LAKE SE (SHEET 45)
8 TURTLE LAKE SW (SHEET 46)

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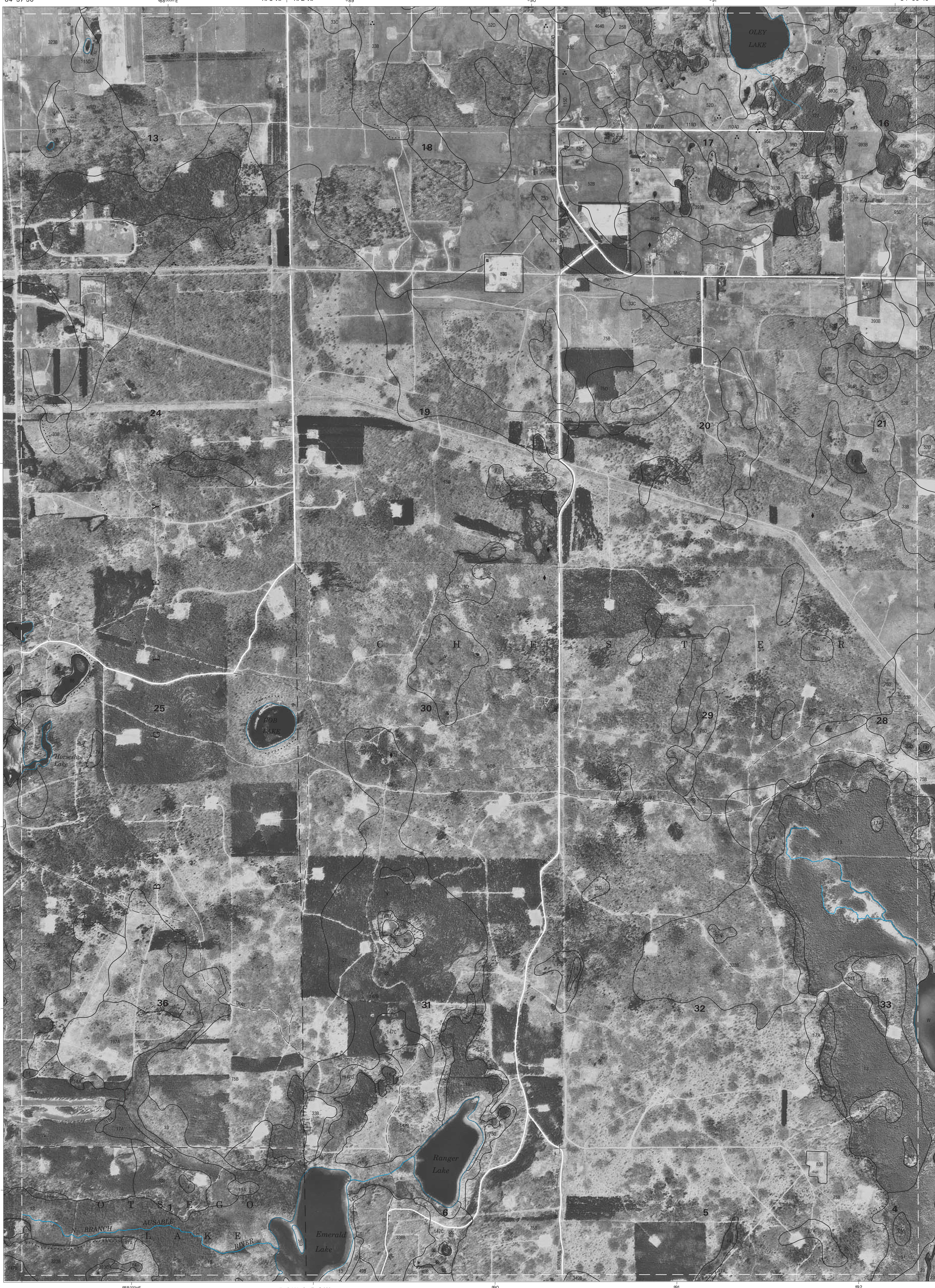
OTSEGO LAKE NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 36 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
TURTLE LAKE NW QUADRANGLE
SHEET NUMBER 37 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES 0.5 0 0.5

FEET 500 0 500 1000 1500 2000 2500 3000 3500

KILOMETERS 0.5 0 0.5

INDEX TO ADJOINING 3.75 MAPS

1 GAYLORD SE (SHEET 27)
2 SPARR SW (SHEET 28)
3 SPARR SE (SHEET 29)
4 OTSEGO LAKE NE (SHEET 36)
5 TURTLE LAKE NE (SHEET 38)
6 OTSEGO LAKE SE (SHEET 45)
7 TURTLE LAKE SW (SHEET 46)
8 TURTLE LAKE SE (SHEET 47)

TURTLE LAKE NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 37 OF 59

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DEPARTMENT OF AGRICULTURE
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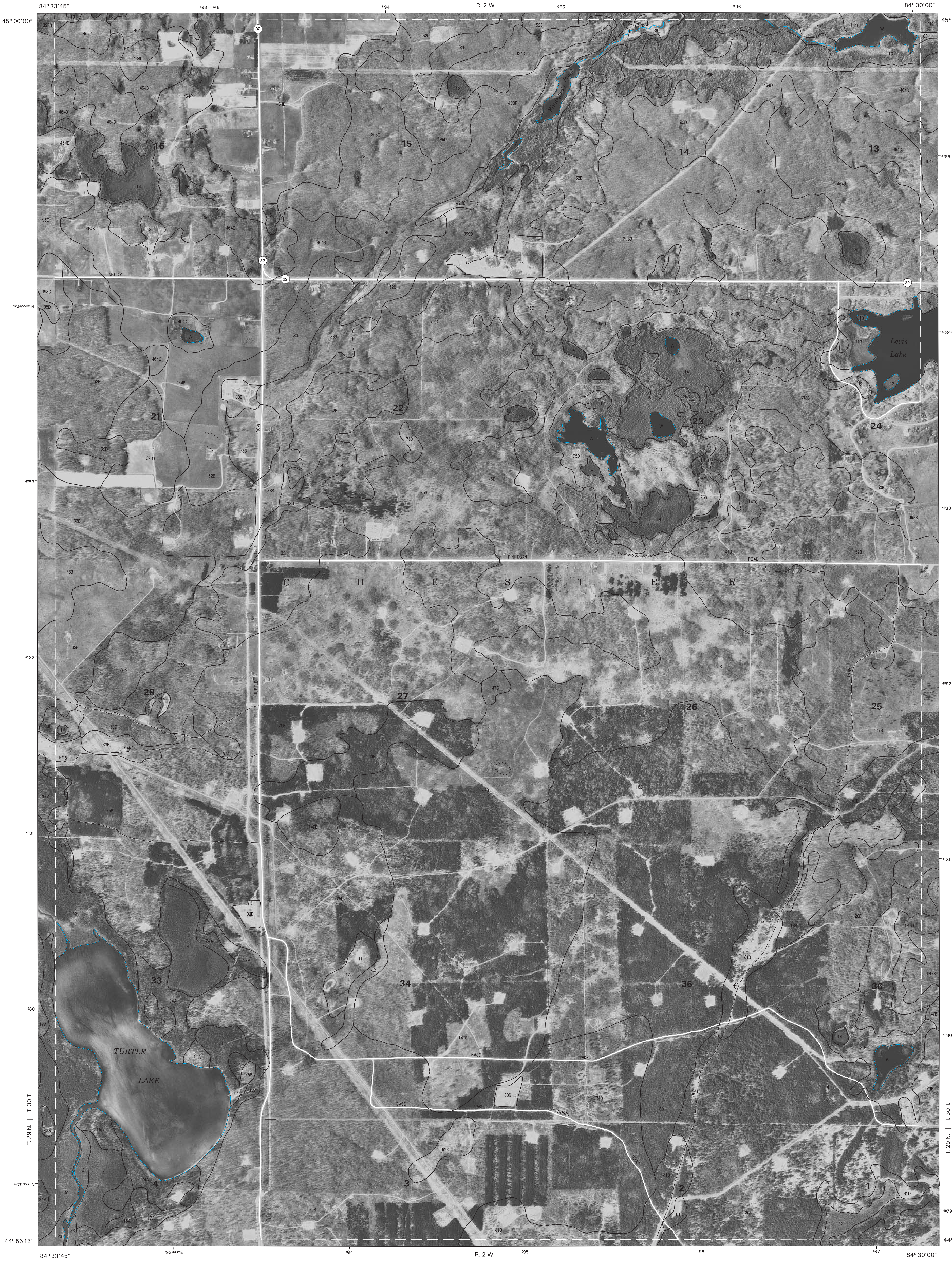
OTSEGO COUNTY, MICHIGAN
TURTLE LAKE NE QUADRANGLE
SHEET NUMBER 38 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 SPARR SW (SHEET 28)
2 SPARR SE (SHEET 29)
3 SAUNDERS CREEK SW (SHEET 30)
4 TURTLE LAKE NW (SHEET 37)
5 JOHANNESBURG NW (SHEET 39)
6 TURTLE LAKE SW (SHEET 46)
7 TURTLE LAKE SE (SHEET 47)
8 JOHANNESBURG SW (SHEET 48)

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TURTLE LAKE NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 38 OF 59

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DEPARTMENT OF AGRICULTURE
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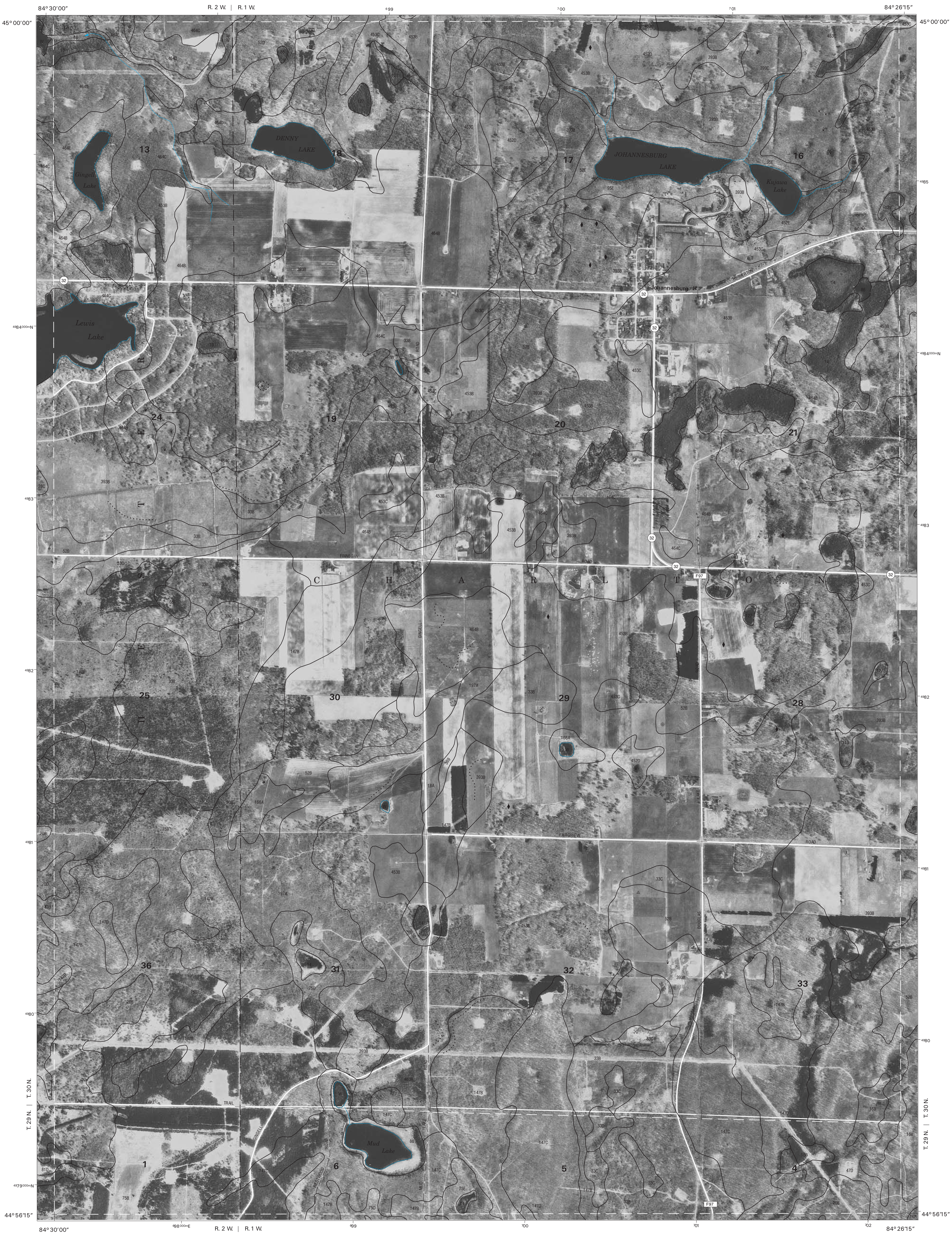
OTSEGO COUNTY, MICHIGAN
JOHANNESBURG NW QUADRANGLE
SHEET NUMBER 39 OF 59



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North American Datum of 1983 (NAD83), GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 16.
Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 SPARR SE (SHEET 29)
2 SAUNDERS CREEK SW (SHEET 30)
3 SAUNDERS CREEK SE (SHEET 31)
4 TURTLE LAKE NE (SHEET 38)
5 JOHANNESBURG NE (SHEET 40)
6 TURTLE LAKE SE (SHEET 47)
7 JOHANNESBURG SW (SHEET 48)
8 JOHANNESBURG SE (SHEET 49)

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JOHANNESBURG NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 39 OF 59

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SCALE 1:12000

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

MILES 0.5 0 0.5

FEET 500 0 500 1000 1500 2000 2500 3000 3500

KILOMETERS 0.5 0 0.5

1 SAUNDERS CREEK SW (SHEET 30)
2 SAUNDERS CREEK SE (SHEET 31)
3 HETHERTON SW (SHEET 32)
4 JOHANNESBURG NW (SHEET 39)
5 LEWISTON NW (SHEET 41)
6 JOHANNESBURG SW (SHEET 48)
7 JOHANNESBURG SE (SHEET 49)
8 LEWISTON SW (SHEET 50)

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JOHANNESBURG NE, MICHIGAN
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Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

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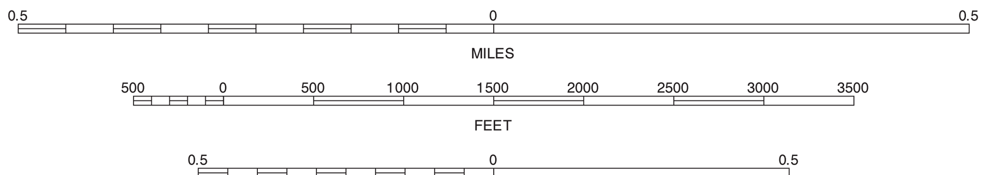
OTSEGO COUNTY, MICHIGAN
LEWISTON NW QUADRANGLE
SHEET NUMBER 41 OF 59

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 SAUNDERS CREEK SE (SHEET 31)
2 HETHERTON SW (SHEET 32)
3 HETHERTON SE (MONTMORENCY COUNTY)
4 JOHANNESBURG NE (SHEET 40)
5 LEWISTON NE (MONTMORENCY COUNTY)
6 JOHANNESBURG SE (SHEET 49)
7 LEWISTON SW (SHEET 50)
8 LEWISTON SE (MONTMORENCY COUNTY)

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LEWISTON NW, MICHIGAN

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Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

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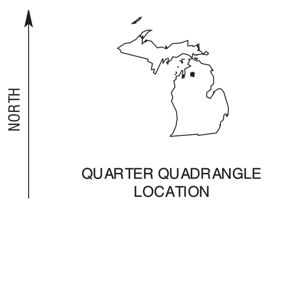
OTSEGO COUNTY, MICHIGAN
LAKE ARROWHEAD SW QUADRANGLE
SHEET NUMBER 42 OF 59

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



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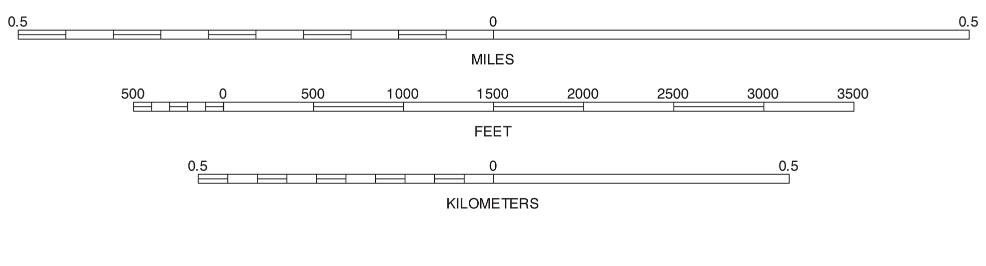

1	2	3
4		5
6	7	8

1 ALBA NE (ANTRIM COUNTY)
2 LAKE ARROWHEAD NW (SHEET 33)
3 LAKE ARROWHEAD NE (SHEET 34)
4 ALBA SE (ANTRIM COUNTY)
5 LAKE ARROWHEAD SE (SHEET 43)
6 STARVATION LAKE NE (ANTRIM COUNTY)
7 FREDERIC NW (SHEET 51)
8 FREDERIC NE (SHEET 52)

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LAKE ARROWHEAD SW, MICHIGAN
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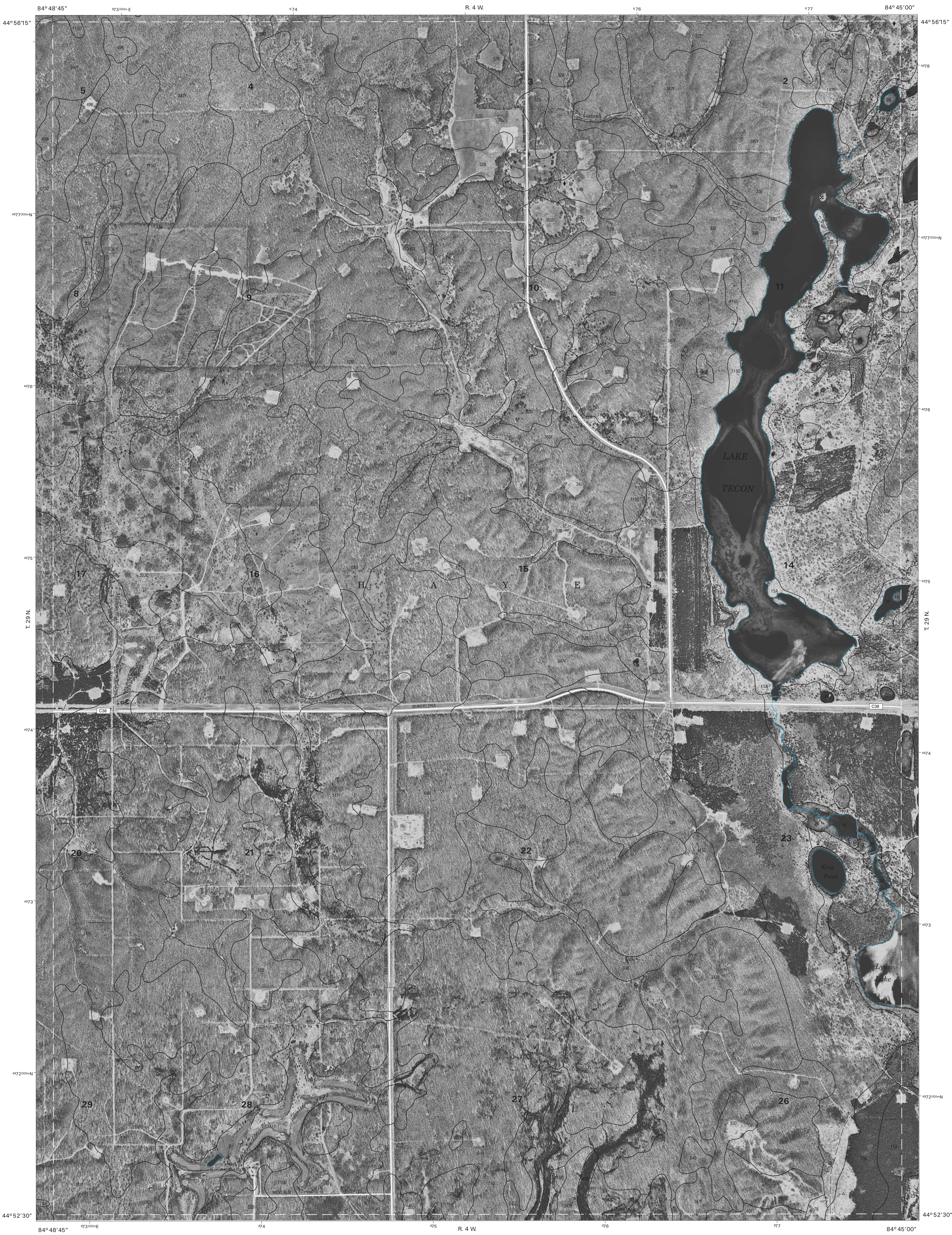
OTSEGO COUNTY, MICHIGAN
LAKE ARROWHEAD SE QUADRANGLE
SHEET NUMBER 43 OF 59



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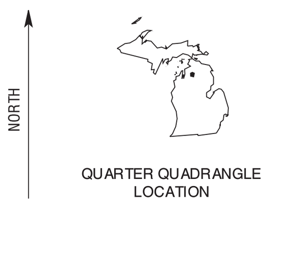
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



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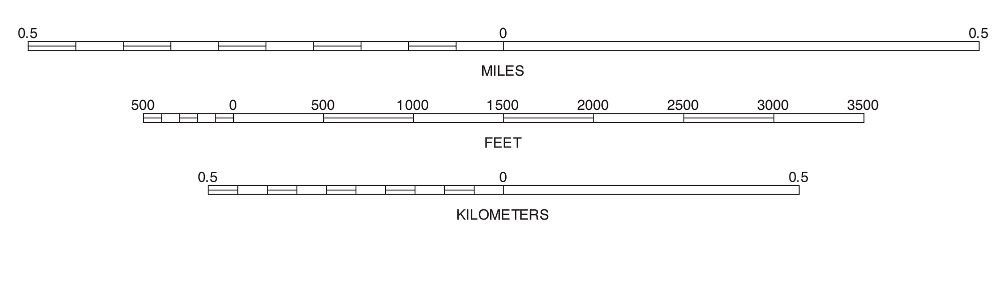

1	2	3
4		5
6	7	8

1 LAKE ARROWHEAD NW (SHEET 33)
2 LAKE ARROWHEAD NE (SHEET 34)
3 OTSEGO LAKE NW (SHEET 35)
4 LAKE ARROWHEAD SW (SHEET 42)
5 OTSEGO LAKE SW (SHEET 44)
6 FREDERIC NW (SHEET 51)
7 FREDERIC NE (SHEET 52)
8 BIG BRADFORD LAKE NW (SHEET 53)

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LAKE ARROWHEAD SE, MICHIGAN

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OTSEGO COUNTY, MICHIGAN
OTSEGO LAKE SW QUADRANGLE
SHEET NUMBER 44 OF 59

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 LAKE ARROWHEAD NE (SHEET 34)
2 OTSEGO LAKE NW (SHEET 35)
3 OTSEGO LAKE NE (SHEET 36)
4 LAKE ARROWHEAD SE (SHEET 43)
5 OTSEGO LAKE SE (SHEET 45)
6 FREDERIC NE (SHEET 52)
7 BIG BRADFORD LAKE NW (SHEET 53)
8 BIG BRADFORD LAKE NE (SHEET 54)

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OTSEGO LAKE SW, MICHIGAN
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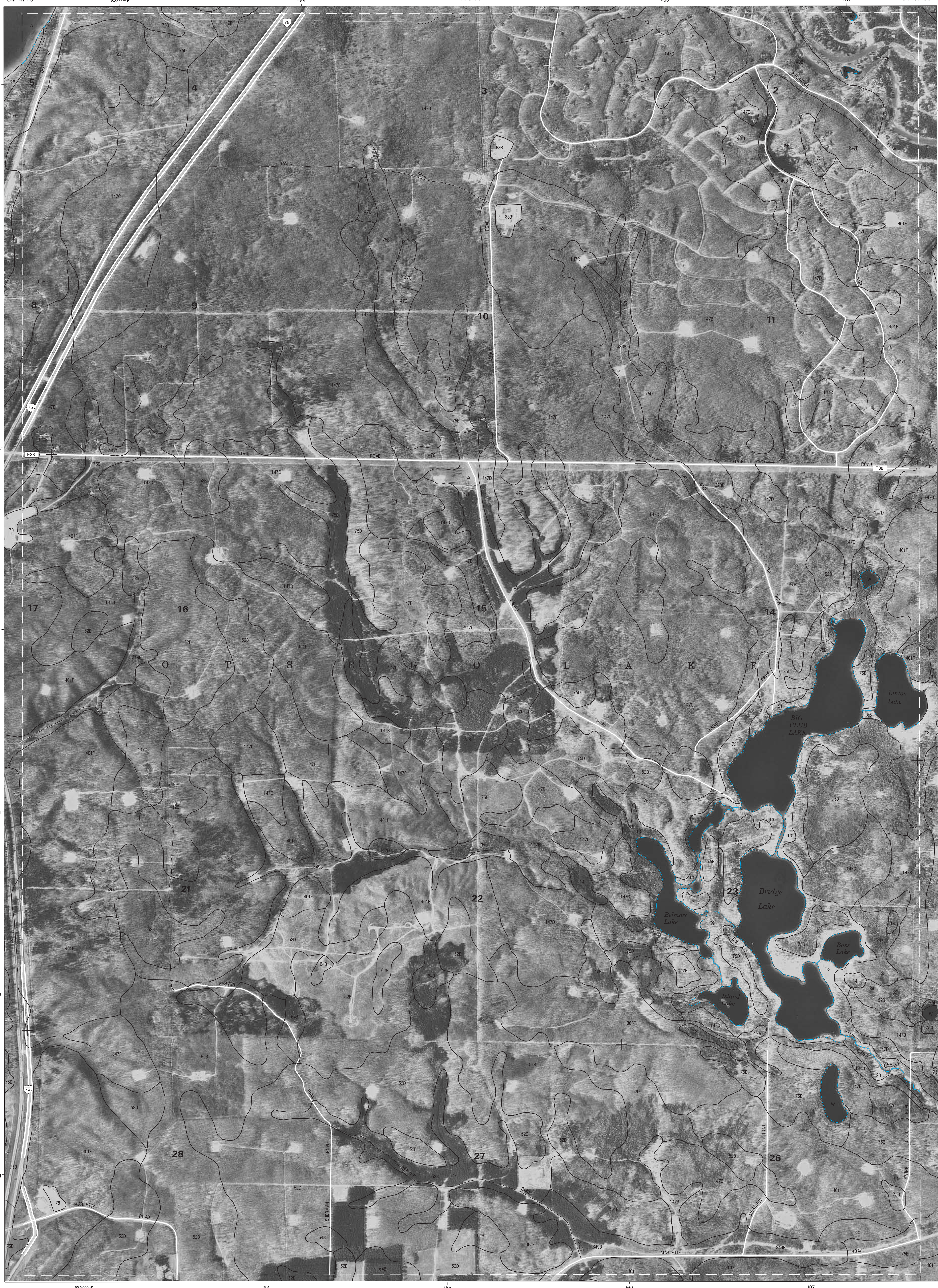
OTSEGO COUNTY, MICHIGAN
OTSEGO LAKE SE QUADRANGLE
SHEET NUMBER 45 OF 59



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 OTSEGO LAKE NW (SHEET 35)
2 OTSEGO LAKE NE (SHEET 36)
3 TURTLE LAKE NW (SHEET 37)
4 OTSEGO LAKE SW (SHEET 44)
5 TURTLE LAKE SW (SHEET 46)
6 BIG BRADFORD LAKE NW (SHEET 53)
7 BIG BRADFORD LAKE NE (SHEET 54)
8 K-P LAKE NW (SHEET 55)

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OTSEGO LAKE SE, MICHIGAN
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SHEET NUMBER 45 OF 59

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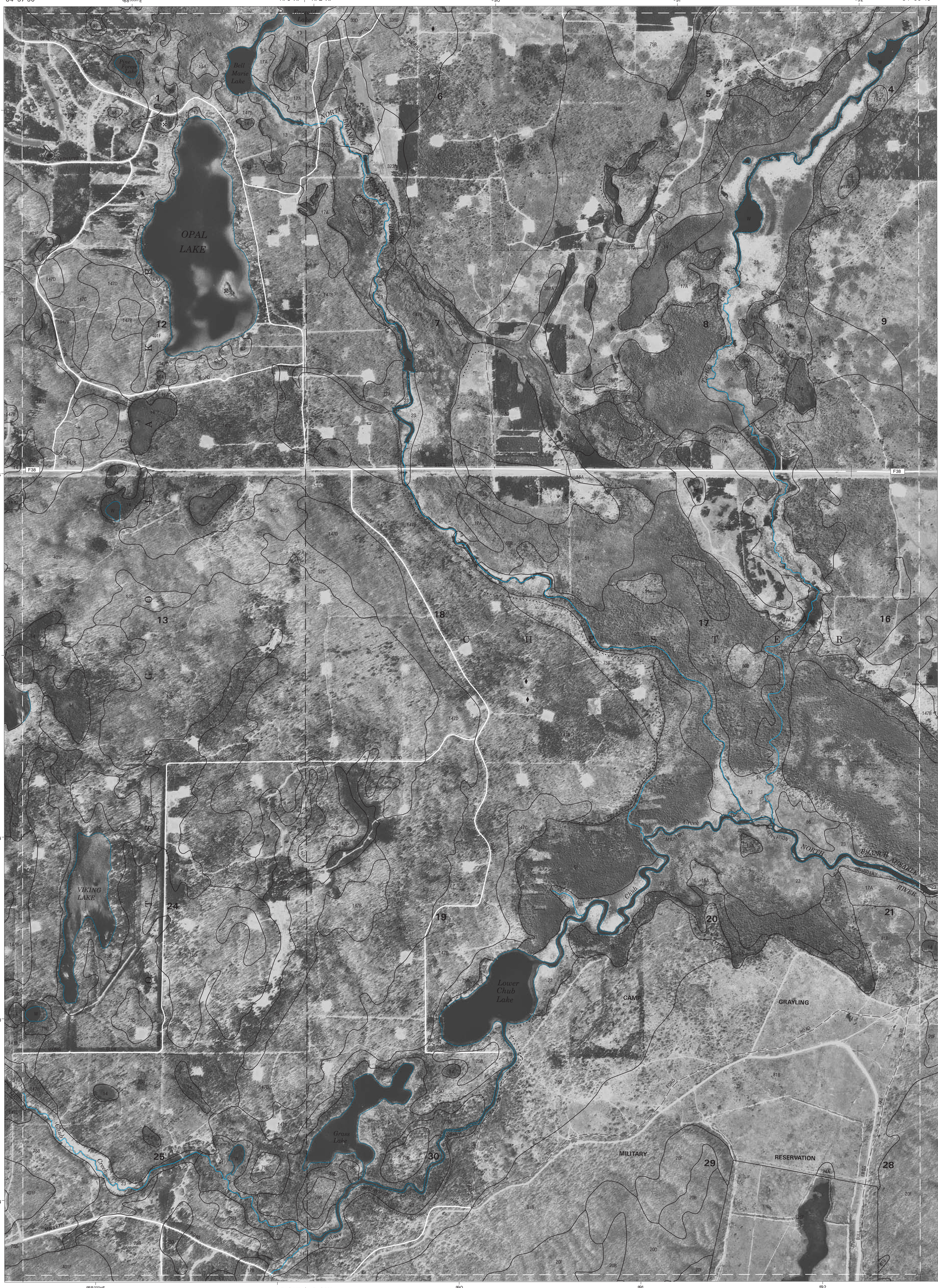
OTSEGO COUNTY, MICHIGAN
TURTLE LAKE SW QUADRANGLE
SHEET NUMBER 46 OF 59



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NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 | 0 | 0.5

FEET: 500 | 0 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 | 3500

KILOMETERS: 0.5 | 0 | 0.5

1	2	3
4		5
6	7	8

1 OTSEGO LAKE NE (SHEET 36)
2 TURTLE LAKE NW (SHEET 37)
3 TURTLE LAKE NE (SHEET 38)
4 OTSEGO LAKE SE (SHEET 45)
5 TURTLE LAKE SE (SHEET 47)
6 BIG BRADFORD LAKE NE (SHEET 54)
7 K-P LAKE NW (SHEET 55)
8 K-P LAKE NE (SHEET 56)

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TURTLE LAKE SW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 46 OF 59

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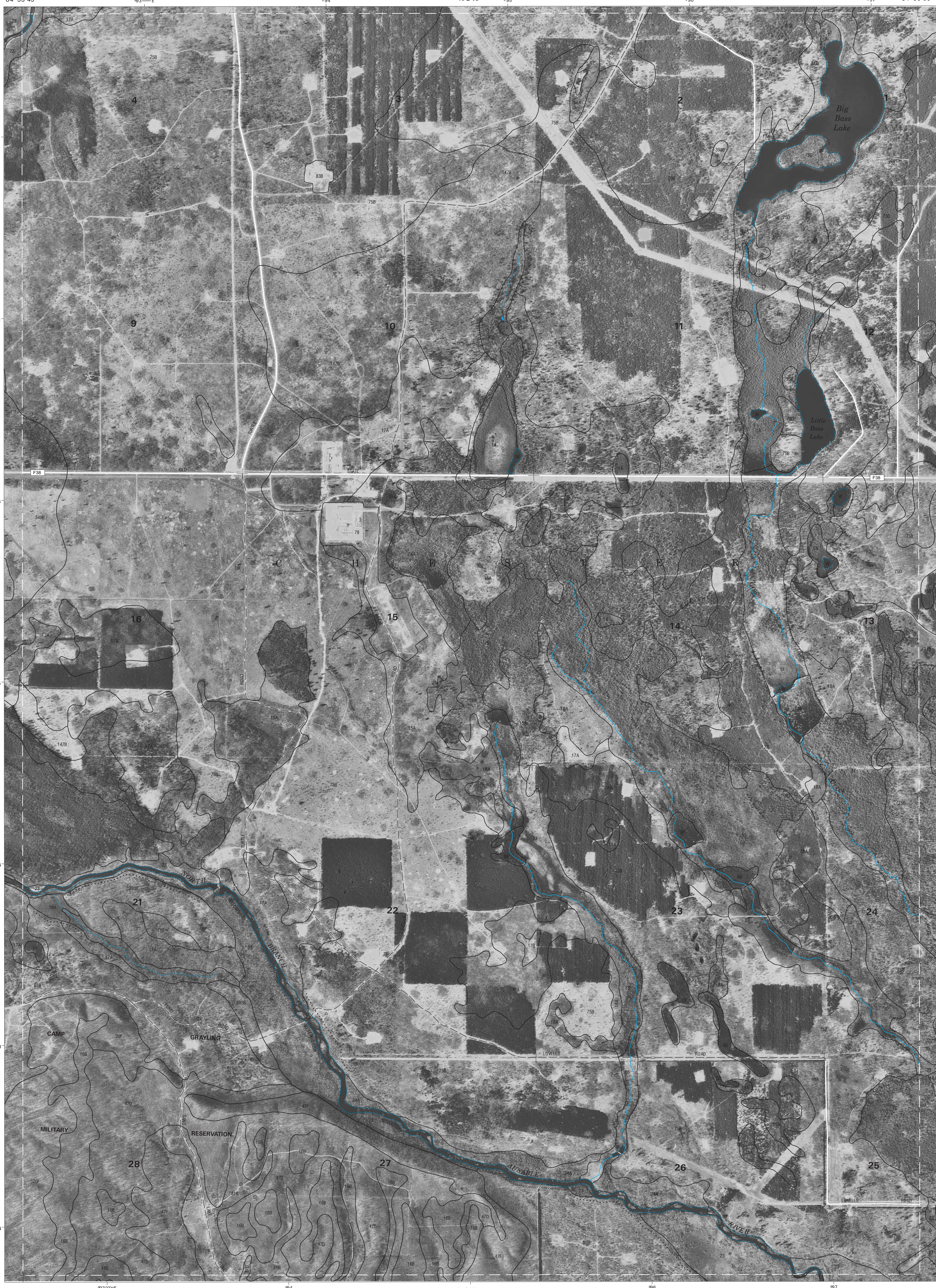

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 — 0 — 0.5 MILES

500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500 FEET

0.5 — 0 — 0.5 KILOMETERS

1	2	3
4		5
6	7	8

1 TURTLE LAKE NW (SHEET 37)
2 TURTLE LAKE NE (SHEET 38)
3 JOHANNESBURG NW (SHEET 39)
4 TURTLE LAKE SW (SHEET 46)
5 JOHANNESBURG SW (SHEET 48)
6 K-P LAKE NW (SHEET 55)
7 K-P LAKE NE (SHEET 56)
8 LOVELLS NW (SHEET 57)

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TURTLE LAKE SE, MICHIGAN

3.75 MINUTE SERIES

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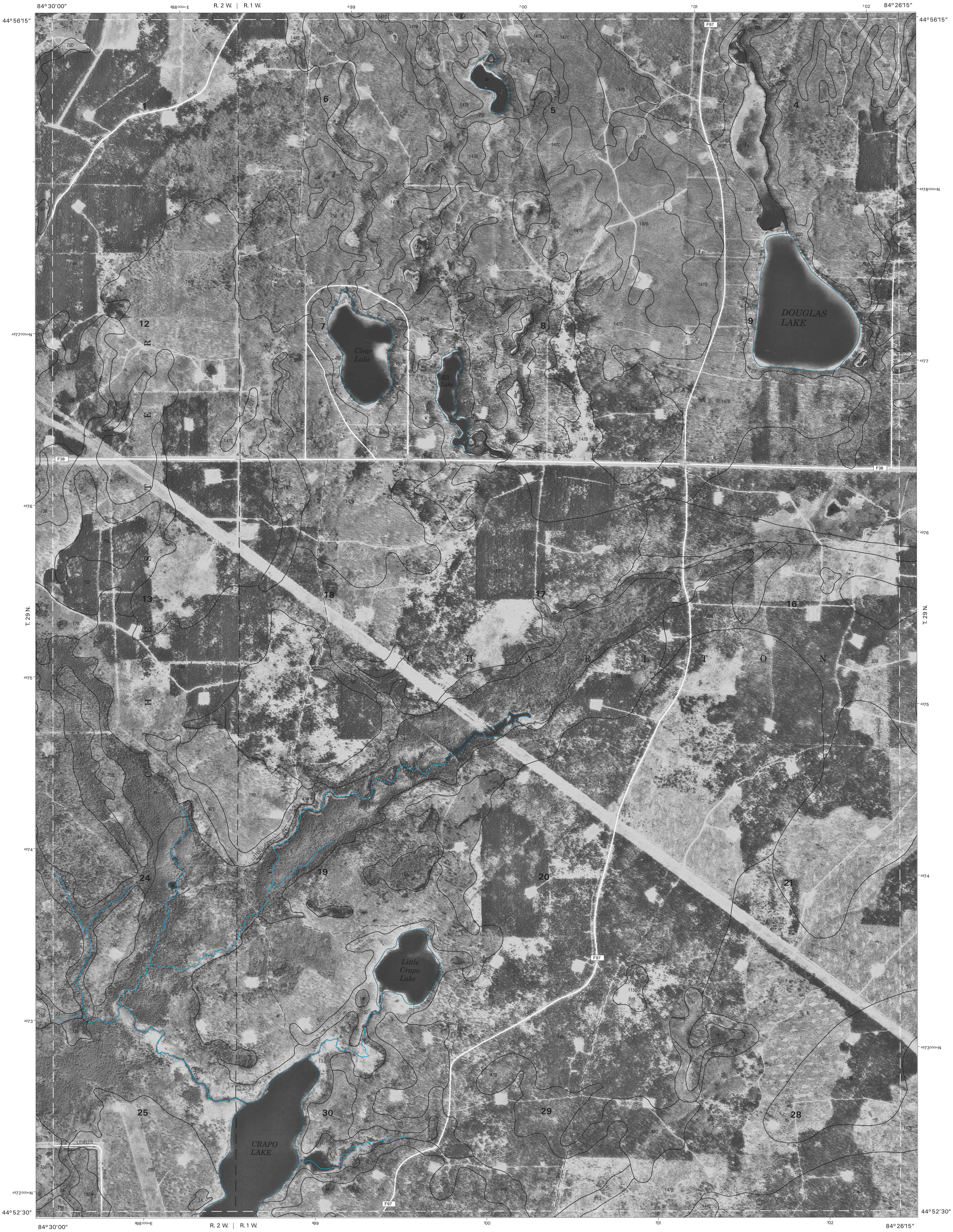
OTSEGO COUNTY, MICHIGAN
JOHANNESBURG SW QUADRANGLE
SHEET NUMBER 48 OF 59



SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

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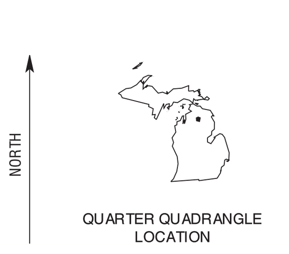
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 TURTLE LAKE NE (SHEET 38)
2 JOHANNESBURG NW (SHEET 39)
3 JOHANNESBURG NE (SHEET 40)
4 TURTLE LAKE SE (SHEET 47)
5 JOHANNESBURG SE (SHEET 49)
6 K-P LAKE NE (SHEET 56)
7 LOVELLS NW (SHEET 57)
8 LOVELLS NE (SHEET 58)

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JOHANNESBURG SW, MICHIGAN
3.75 MINUTE SERIES
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Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

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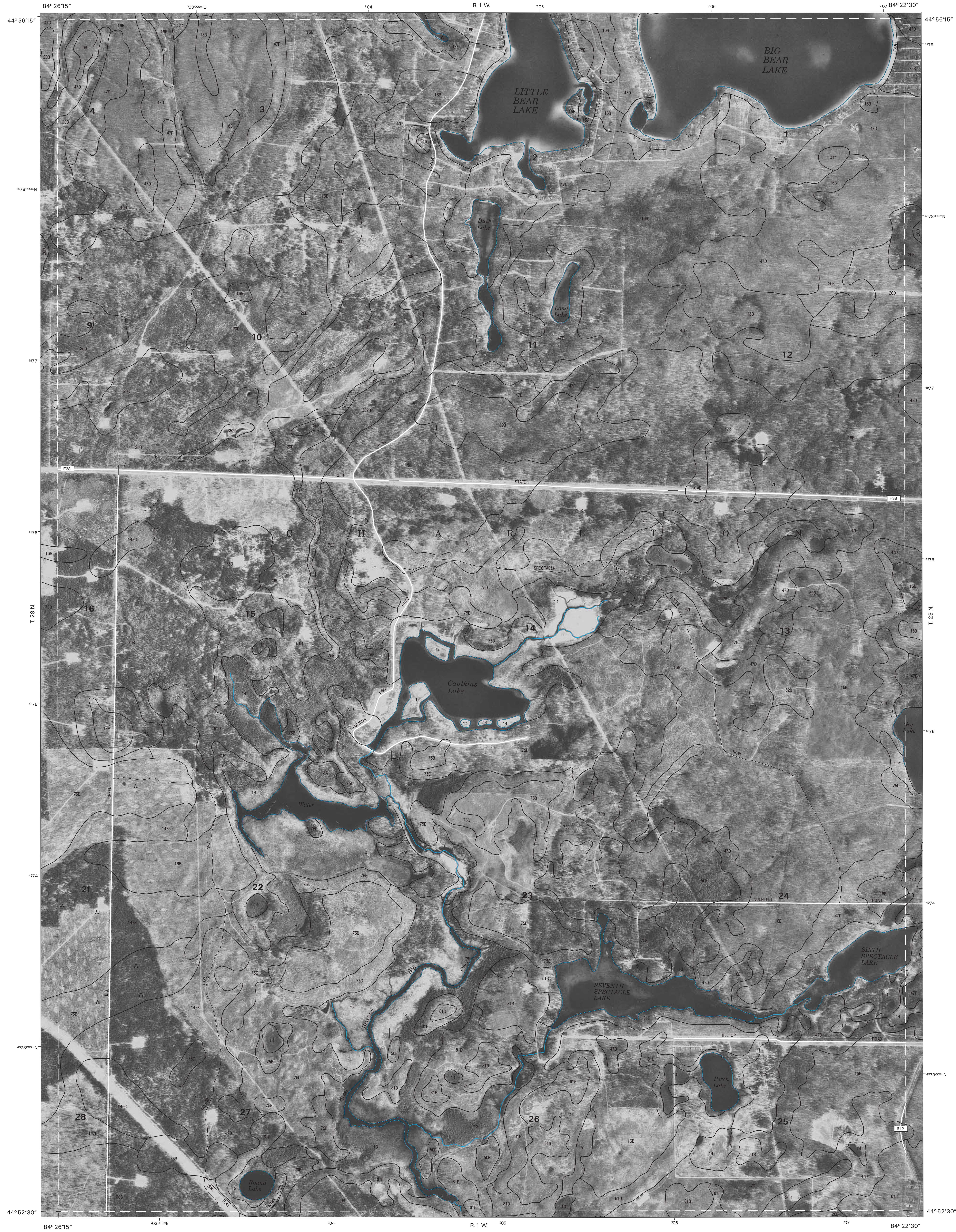
OTSEGO COUNTY, MICHIGAN
JOHANNESBURG SE QUADRANGLE
SHEET NUMBER 49 OF 59



This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5
MILES

500 0 500 1000 1500 2000 2500 3000 3500
FEET

0.5 0 0.5
KILOMETERS

1	2	3
4		5
6	7	8

1 JOHANNESBURG NW (SHEET 39)
2 JOHANNESBURG NE (SHEET 40)
3 LEWISTON NW (SHEET 41)
4 JOHANNESBURG SW (SHEET 48)
5 LEWISTON SW (SHEET 50)
6 LOVELLS NW (SHEET 57)
7 LOVELLS NE (SHEET 58)
8 COMSTOCK HILLS NW (SHEET 59)

INDEX TO ADJOINING 3.75 MAPS

JOHANNESBURG SE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 49 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

SCALE 1:12000

0.5 0 0.5
MILES
500 0 500 1000 1500 2000 2500 3000 3500
FEET
0.5 0 0.5
KILOMETERS

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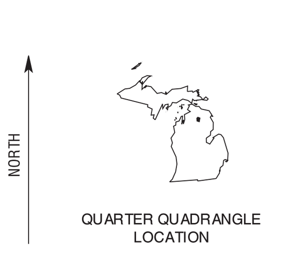
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 JOHANNESBURG NE (SHEET 40)
2 LEWISTON NW (SHEET 41)
3 LEWISTON NE (MONTMORENCY COUNTY)
4 JOHANNESBURG SE (SHEET 49)
5 LEWISTON SE (MONTMORENCY COUNTY)
6 LOVELLS NE (SHEET 58)
7 COMSTOCK HILLS NW (SHEET 59)
8 COMSTOCK HILLS NE (MONTMORENCY COUNTY)

INDEX TO ADJOINING 3.75 MAPS

LEWISTON SW, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 50 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
FREDERIC NW QUADRANGLE
SHEET NUMBER 51 OF 59

This soil survey was compiled by the U.S. Department of Agriculture, Natural Resources Conservation Service and co-operating agencies. Base maps are orthophotographs prepared by the U.S. Department of Interior, Geological Survey, from 1992-1994 aerial photography. The hydrography and cultural information were (was) acquired from the U.S. Geological Survey. The hydrography and cultural information were (was) edited to conform with features represented on the publication orthophotography and to enhance the clarity of the soils information.

North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 ALBA SE (ANTRIM COUNTY)
2 LAKE ARROWHEAD SW (SHEET 42)
3 LAKE ARROWHEAD SE (SHEET 43)
4 STARVATION LAKE NE (ANTRIM COUNTY)
5 FREDERIC NE (SHEET 52)
6 STARVATION LAKE SE (KALKASKA COUNTY)
7 FREDERIC SW (CRAWFORD COUNTY)
8 FREDERIC SE (CRAWFORD COUNTY)

INDEX TO ADJOINING 3.75 MAPS

FREDERIC NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 51 OF 59

Soil map delineations extending beyond the dashed white quadrangle neatline are for reference only and are included on adjacent map sheets.

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DEPARTMENT OF AGRICULTURE
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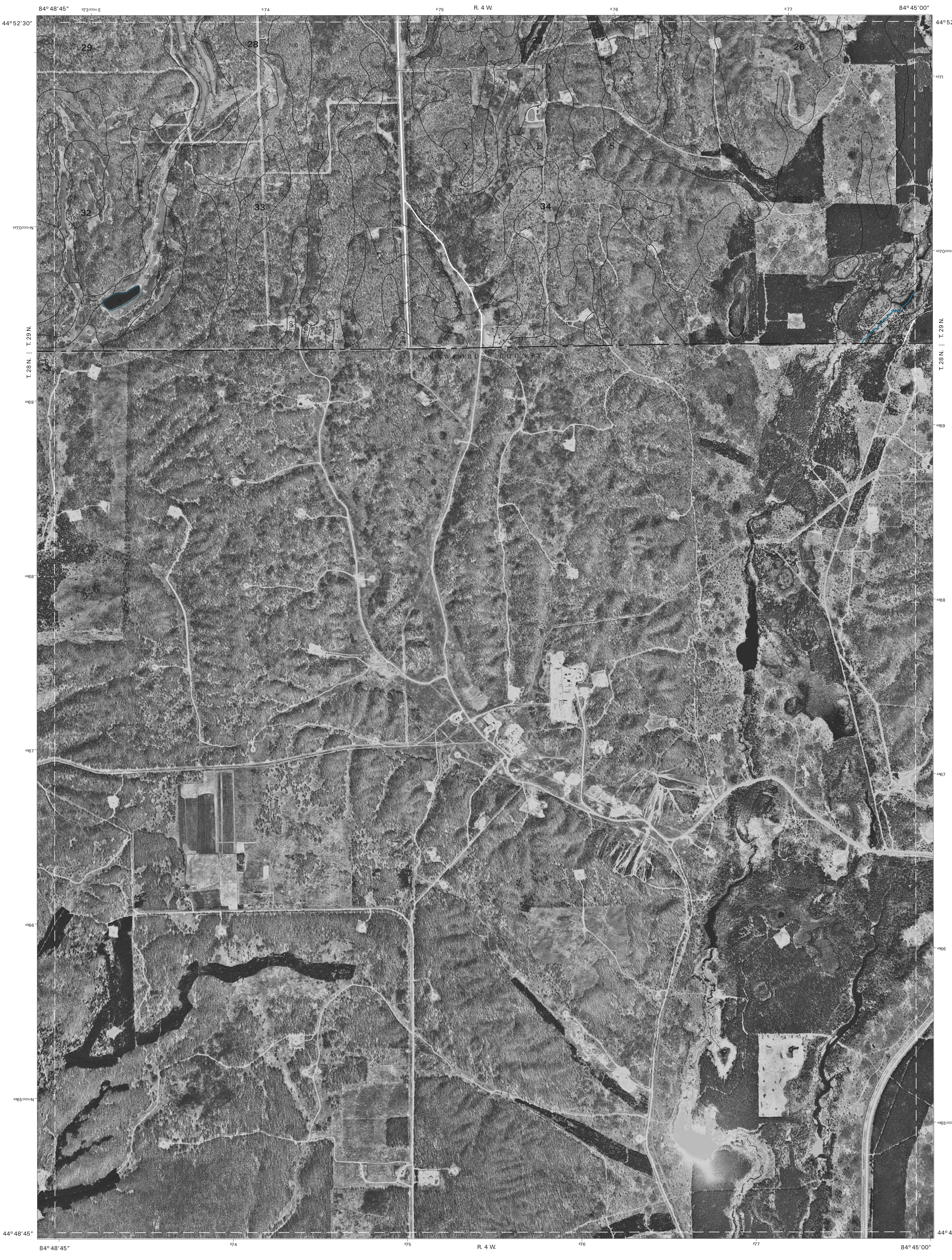
OTSEGO COUNTY, MICHIGAN
FREDERIC NE QUADRANGLE
SHEET NUMBER 52 OF 59



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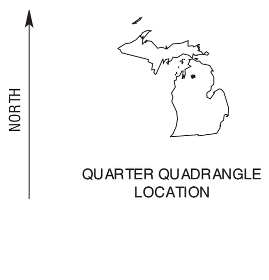
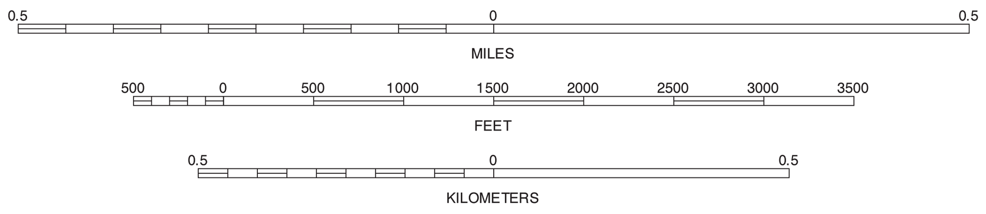
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



QUARTER QUADRANGLE LOCATION

SCALE 1:12000



1	2	3
4		5
6	7	8

1 LAKE ARROWHEAD SW (SHEET 42)
2 LAKE ARROWHEAD SE (SHEET 43)
3 OTSEGO LAKE SW (SHEET 44)
4 FREDERIC NW (SHEET 51)
5 BIG BRADFORD LAKE NW (SHEET 53)
6 FREDERIC SW (CRAWFORD COUNTY)
7 FREDERIC SE (CRAWFORD COUNTY)
8 BIG BRADFORD LAKE SW (CRAWFORD COUNTY)

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FREDERIC NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 52 OF 59

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UNITED STATES
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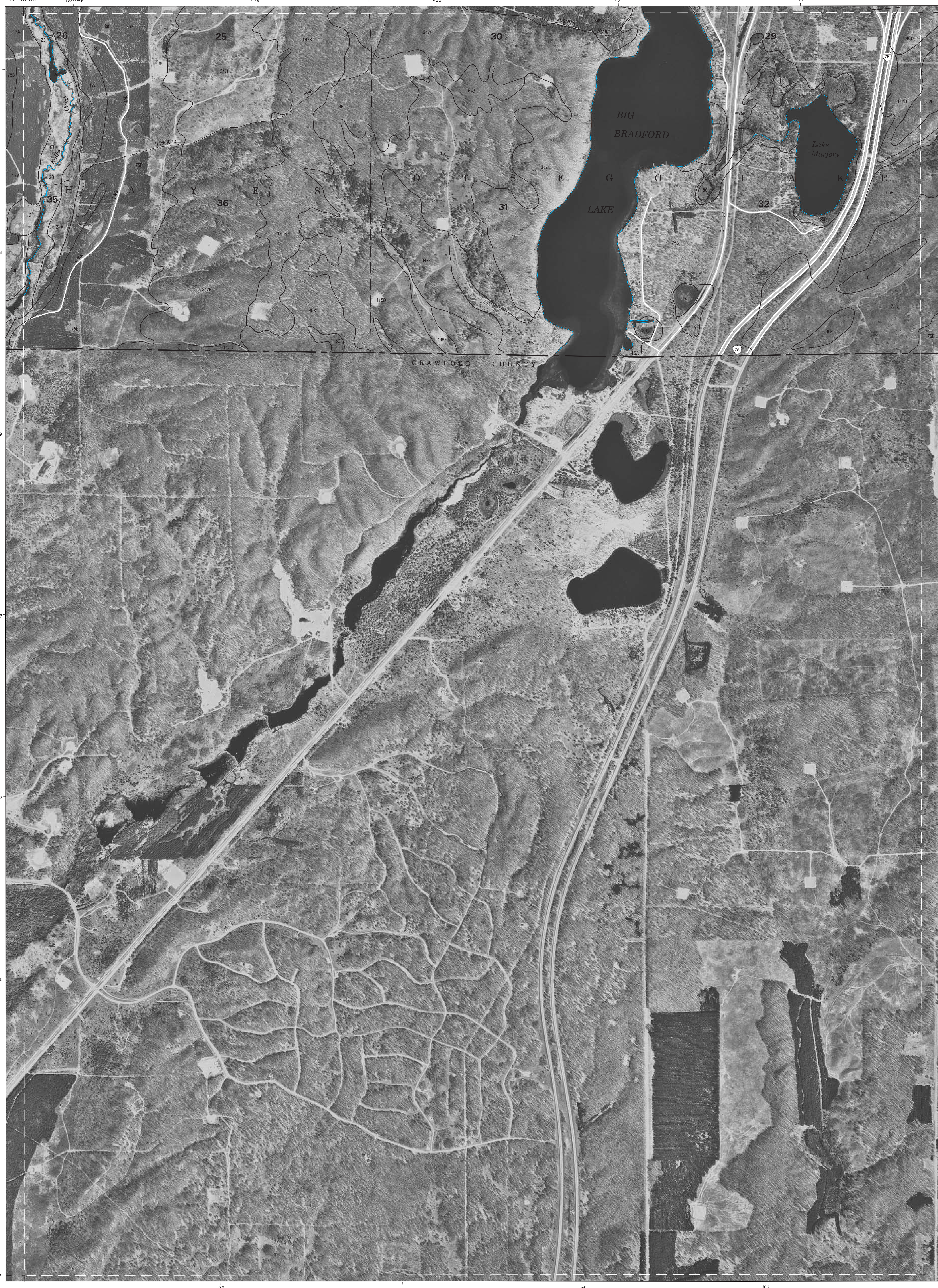
OTSEGO COUNTY, MICHIGAN
BIG BRADFORD LAKE NW QUADRANGLE
SHEET NUMBER 53 OF 59

84° 45′00″ | 678000m E | 679 | R. 4 W. | R. 3 W. | 680 | 681 | 682 | 84° 41′15″

44° 52′30″



44° 48′45″

84° 45′00″ | 679 | R. 4 W. | R. 3 W. | 681 | 682 | 84° 41′15″

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North American Datum of 1983 (NAD83). GRS-80 Spheroid
1000-meter ticks: Universal Transverse Mercator, zone 16.
Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 — 0 — 0.5 MILES

500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500 FEET

0.5 — 0 — 0.5 KILOMETERS

1	2	3
4		5
6	7	8

1 LAKE ARROWHEAD SE (SHEET 43)
2 OTSEGO LAKE SW (SHEET 44)
3 OTSEGO LAKE SE (SHEET 45)
4 FREDERIC NE (SHEET 52)
5 BIG BRADFORD LAKE NE (SHEET 54)
6 FREDERIC SE (CRAWFORD COUNTY)
7 BIG BRADFORD LAKE SW (CRAWFORD COUNTY)
8 BIG BRADFORD LAKE SE (CRAWFORD COUNTY)

INDEX TO ADJOINING 3.75 MAPS

BIG BRADFORD LAKE NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 53 OF 59

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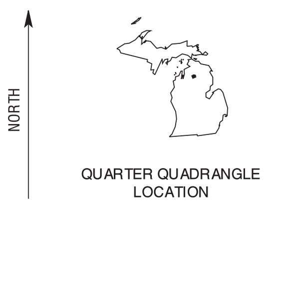
North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.



SCALE 1:12000

0.5 0 0.5 MILES

500 0 500 1000 1500 2000 2500 3000 3500 FEET

0.5 0 0.5 KILOMETERS

1	2	3
4		5
6	7	8

INDEX TO ADJOINING 3.75 MAPS

1 OTSEGO LAKE SW (SHEET 44)
2 OTSEGO LAKE SE (SHEET 45)
3 TURTLE LAKE SW (SHEET 46)
4 BIG BRADFORD LAKE NW (SHEET 53)
5 K-P LAKE NW (SHEET 55)
6 BIG BRADFORD LAKE SW (CRAWFORD COUNTY)
7 BIG BRADFORD LAKE SE (CRAWFORD COUNTY)
8 K-P LAKE SW (CRAWFORD COUNTY)

BIG BRADFORD LAKE NE, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 54 OF 59

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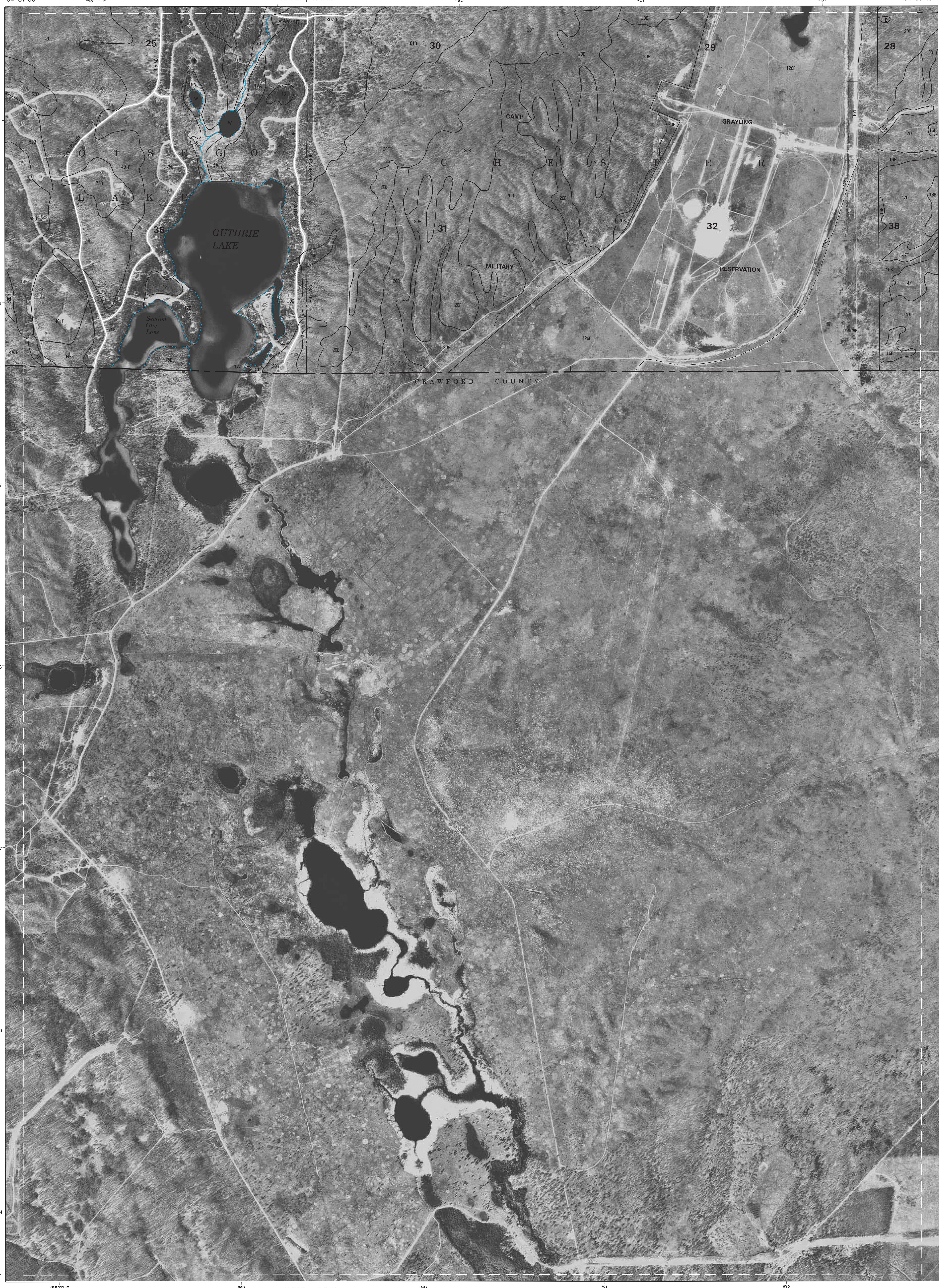
UNITED STATES
DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

OTSEGO COUNTY, MICHIGAN
K P LAKE NW QUADRANGLE
SHEET NUMBER 55 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES: 0.5 — 0 — 0.5

FEET: 500 — 0 — 500 — 1000 — 1500 — 2000 — 2500 — 3000 — 3500

KILOMETERS: 0.5 — 0 — 0.5

1	2	3
4		5
6	7	8

1 OTSEGO LAKE SE (SHEET 45)
2 TURTLE LAKE SW (SHEET 46)
3 TURTLE LAKE SE (SHEET 47)
4 BIG BRADFORD LAKE NE (SHEET 54)
5 K-P LAKE NE (SHEET 56)
6 BIG BRADFORD LAKE SE (CRAWFORD COUNTY)
7 K-P LAKE SW (CRAWFORD COUNTY)
8 K-P LAKE SE (CRAWFORD COUNTY)

INDEX TO ADJOINING 3.75 MAPS

K P LAKE NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 55 OF 59

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NATURAL RESOURCES CONSERVATION SERVICE

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1 TURTLE LAKE SW (SHEET 46)
2 TURTLE LAKE SE (SHEET 47)
3 JOHANNESBURG SW (SHEET 48)
4 K-P LAKE NW (SHEET 55)
5 LOVELLS NW (SHEET 57)
6 K-P LAKE SW (CRAWFORD COUNTY)
7 K-P LAKE SE (CRAWFORD COUNTY)
8 LOVELLS SW (CRAWFORD COUNTY)

INDEX TO ADJOINING 3.75 MAPS

K P LAKE NE, MICHIGAN

3.75 MINUTE SERIES
SHEET NUMBER 56 OF 59

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UNITED STATES
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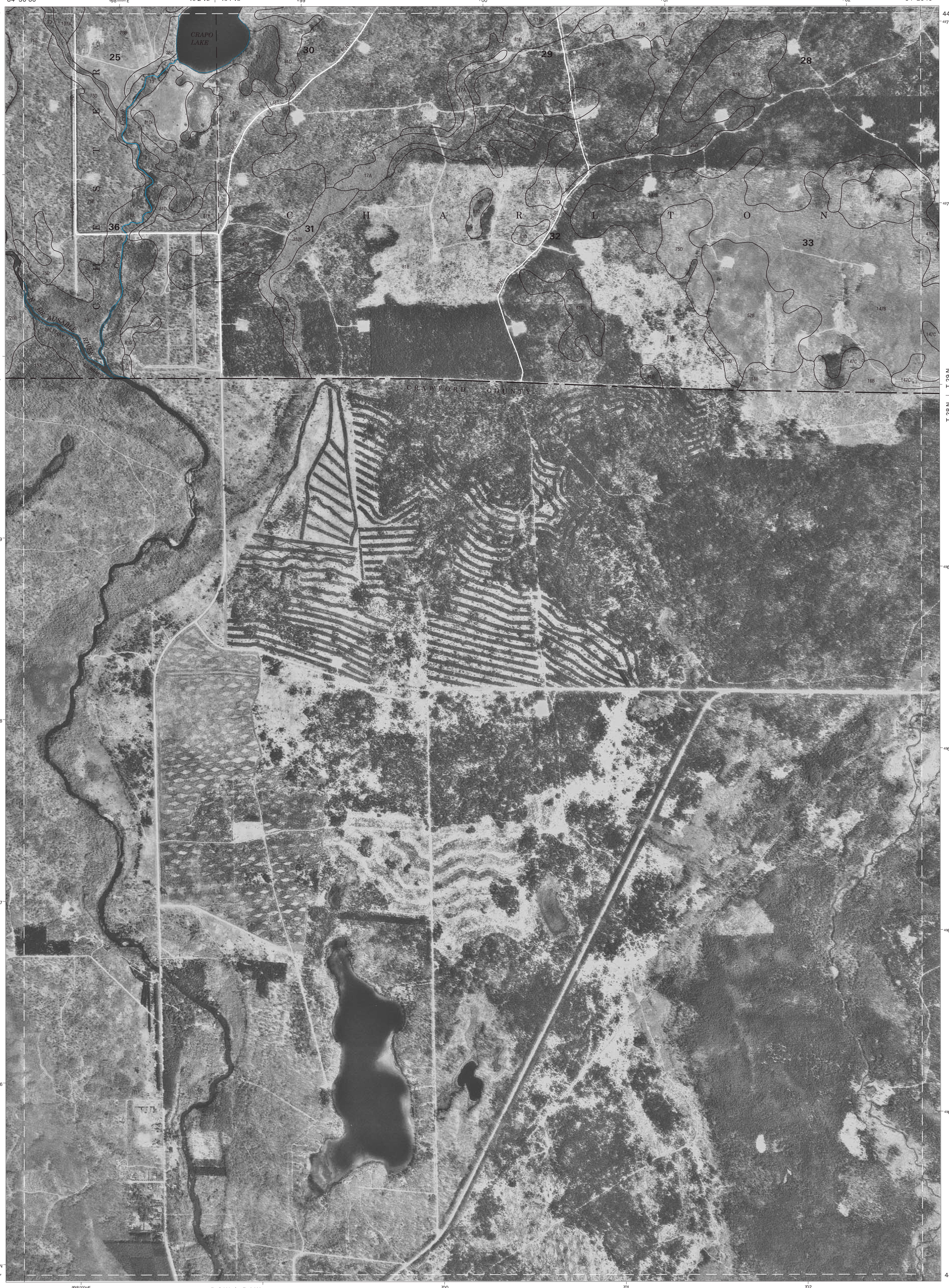
OTSEGO COUNTY, MICHIGAN
LOVELLS NW QUADRANGLE
SHEET NUMBER 57 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1	2	3
4		5
6	7	8

1 TURTLE LAKE SE (SHEET 47)
2 JOHANNESBURG SW (SHEET 48)
3 JOHANNESBURG SE (SHEET 49)
4 K-P LAKE NE (SHEET 56)
5 LOVELLS NE (SHEET 58)
6 K-P LAKE SE (CRAWFORD COUNTY)
7 LOVELLS SW (CRAWFORD COUNTY)
8 LOVELLS SE (CRAWFORD COUNTY)

INDEX TO ADJOINING 3.75 MAPS

LOVELLS NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 57 OF 59

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OTSEGO COUNTY, MICHIGAN
LOVELLS NE QUADRANGLE

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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

NORTH

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

MILES

FEET

KILOMETERS

1 JOHANNESBURG SW (SHEET 48)
2 JOHANNESBURG SE (SHEET 49)
3 LEWISTON SW (SHEET 50)
4 LOVELLS NW (SHEET 57)
5 COMSTOCK HILLS NW (SHEET 59)
6 LOVELLS SW (CRAWFORD COUNTY)
7 LOVELLS SE (CRAWFORD COUNTY)
8 COMSTOCK HILLS SW (CRAWFORD COUNTY)

INDEX TO ADJOINING 3.75 MAPS

LOVELLS NE, MICHIGAN
3.75 MINUTE SERIES

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UNITED STATES
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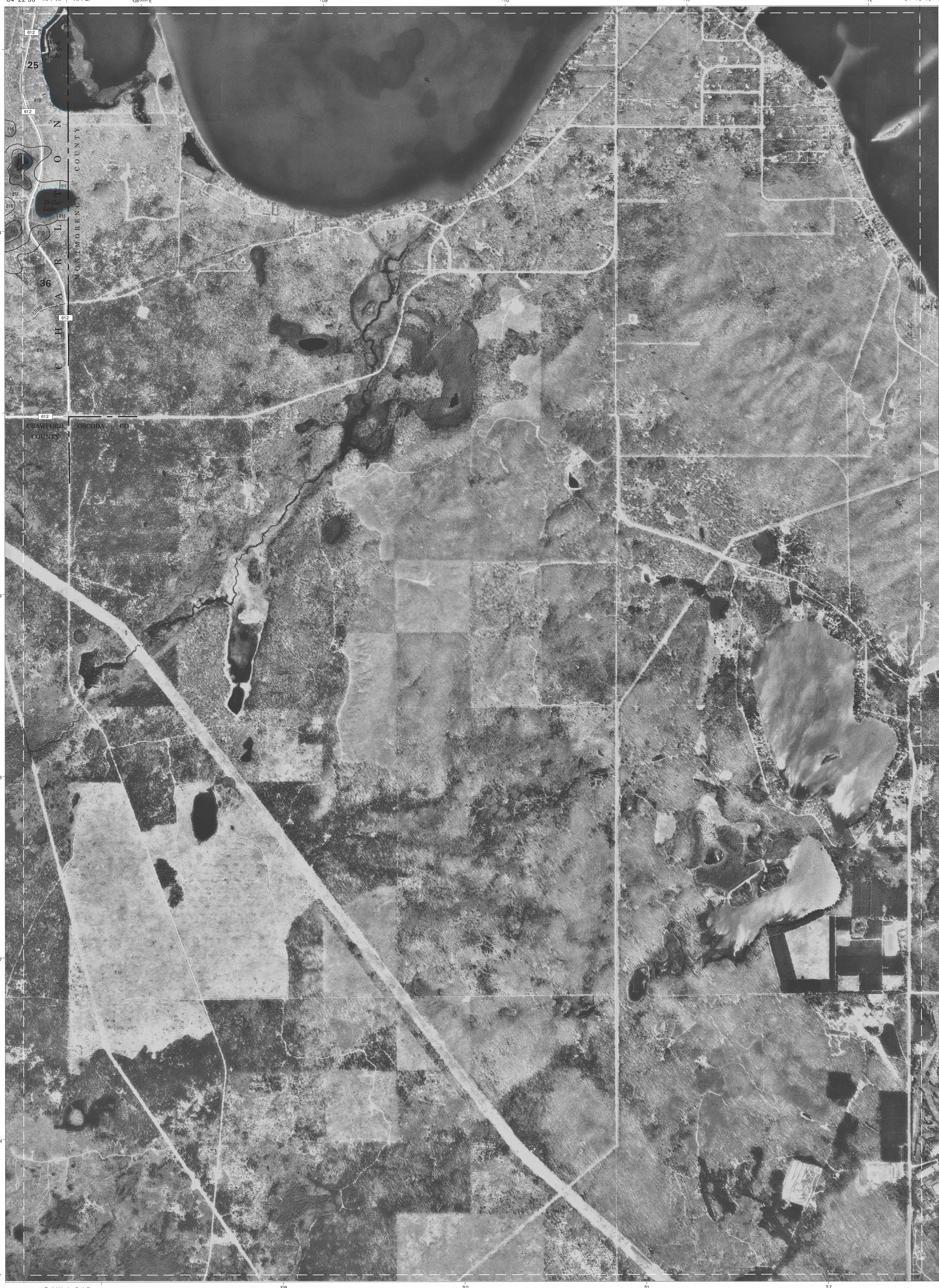
OTSEGO COUNTY, MICHIGAN
COMSTOCK HILLS NW QUADRANGLE
SHEET NUMBER 59 OF 59



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North American Datum of 1983 (NAD83). GRS-80 Spheroid 1000-meter ticks: Universal Transverse Mercator, zone 16. Coordinate grid ticks and land division data, if shown, are approximately positioned. Digital data are available for this quadrangle.

QUARTER QUADRANGLE LOCATION

SCALE 1:12000

0.5 0 0.5 MILES

500 0 500 1000 1500 2000 2500 3000 3500 FEET

0.5 0 0.5 KILOMETERS

1	2	3
4		5
6	7	8

1 JOHANNESBURG SE (SHEET 49)
2 LEWISTON SW (SHEET 50)
3 LEWISTON SE (MONTMORENCY COUNTY)
4 LOVELLS NE (SHEET 58)
5 COMSTOCK HILLS NE (MONTMORENCY COUNTY)
6 LOVELLS SE (CRAWFORD COUNTY)
7 COMSTOCK HILLS SW (CRAWFORD COUNTY)
8 COMSTOCK HILLS SE (OSCODA COUNTY)

INDEX TO ADJOINING 3.75 MAPS

COMSTOCK HILLS NW, MICHIGAN
3.75 MINUTE SERIES
SHEET NUMBER 59 OF 59

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